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The Farmer's Digest

Volume 12 May, 1948 Number 1

Safe Lightning Protection

Condensed from Agricultural Engineering

R. D. Bienemann

Member, American Society of Agricultural Engineers

ALTHOUGH many thousands of buildings are protected against lightning, it still is the prime cause of farm fires. Lightning accounts for 31 percent of the country's annual farm fire loss, double that of the second greatest cause, defective chimneys and flues.

Causes of farm fires as compiled by the National Board of Fire Underwriters

In Iowa, during a two-year period, 503 unprotected buildings were damaged to the extent of $1,060,668, an average of $2,000 per building. In the same period twenty-eight so-called "protected" buildings were damaged. The loss ratio on "protected" buildings in this particular case is very small, approximately 5 percent of the unprotected buildings. Unfortunately, for our present purpose, no attempt was made to check condition and original adequacy of the lightning-protection installations of these twenty-eight "protected" buildings. Obviously, however, these installations could not have been classed as "safe lightning protection."

What constitutes safe lightning protection? In order to determine what procedure to follow in the installation of lightning protection, we must first have a knowledge of the phenomenon "lightning," and its action under various circumstances.

Reprinted by permission from Agricultural Engineering, November, 1947, St. Joseph, Michigan

When storm clouds gather they store up on themselves great quantities of electricity. These static charges may be either positive or negative with respect to adjacent objects or masses; hence the reason for many discharges from cloud to cloud. In lightning, as in all of nature, opposites attract. These atmospheric discharges result in the major concussion of a storm, but cause no actual damage since they do not reach the earth.

While such a storm is approaching, much unseen activity takes place on the surface and inside of the earth. Many millions of negative charges are attracted and drawn by the positive of the atmosphere to points at, near, or in contact with the ground surface. The pressure becomes intense as they flow to the highest elevation possible, preferably following a low-resistance metal path, but otherwise utilizing a chimney or building of relatively non-conducting material. When the pressure or potential becomes sufficiently intense, a portion of the negative charge is pushed off into the atmosphere and bridges the space between its point of origin and the positive charge in air or cloud, with the release of millions of volts and thousands of amperes of pent-up energy.

All of this is completed in a fraction of a second. We have seen the flash of lightning, and heard the crash of thunder, and if our barn or house is still secure we are fortunate.

Scientific development during the years has not been able to prevent the phenomenon from occurring in all cases, but has given us the possibility of preventing any damage to our buildings through the installation of safe lightning protection. We have learned through scientific research and experience that a properly installed lightning protection system provides practically 100 percent protection from the menace from the sky.

Actually lightning protection in the modern manner does prevent what we call a bolt or stroke in *most* cases. The density of charge is most intense at the more remote parts of a charged body, and especially at the end of a pointed extension. From such densely charged points the static electricity leaks off rather rapidly into the surrounding air. This is the main reason why air terminals are sharply pointed, and to secure a sufficient capacity for dissipation is one reason for the number of points employed.

In rare instances the charging rate may so exceed the dissipation rate that the potential rises high enough to break down the dielectric resistance of the air, and a stroke of lightning occurs. In a well-designed system this is unlikely unless there is a break in

the continuity or conductivity of conductors or connectors, or an abnormally high ground resistance. Nevertheless an adequate system always is designed with conductors of such low resistance and such high thermal inertia that they will not melt under a disruptive discharge.

During the dissipation phase of static discharge, the resistance of conductors is of no consequence, but low resistance or certainty of contact with the earth and among the parts of the system is important. If dissipation becomes inadequate and a stroke occurs, everything changes. We have an alternating current or oscillating discharge at fantastically high frequency. Not only must resistance be low enough to handle thousands of amperes, but the inductance must be held close to zero.

Both theory and experience teach us that there must be not a single path, but parallel paths for the high-frequency discharge, and that these paths should be arranged according to a pattern. Hence we usually have at least two each of air terminals, ground electrodes, and connecting cables.

The shape or design of a structure will govern the number of ground electrodes and paths necessary. Single-ridge structures, with no ells or tees, up to 80 ft. in length require two ground terminals; from 80 to 140 ft., three; 140 to 200 ft., four; and one additional ground terminal for each 60 ft. of additional ridge. If a building only 40 ft. in length has an ell or tee of equal height or lower, such a structure requires three grounds. Any dormer wholly between the eaves and ridge requires the coursing of the conductor cables over it, and frequently also an additional ground electrode.

The basic portion of a system of "safe lightning protection" consists of the familiar ground electrodes sunk to a depth of at least 10 ft. where soil conditions permit. Auxiliary grounds are frequently required where rock formation or dry sand is encountered. In such cases ground electrodes are sunk to the maximum depth possible, and additional electrodes added each 6 ft. diagonally out from the building, for distances of 12 ft. or more. Where ledge rock is encountered, it is frequently necessary to bury cable in a trench for a considerable distance to supply adequate grounding, or a belt cable installed around the perimeter of the building, with ground electrodes driven wherever possible and not in excess of 50 ft. apart.

To the driven ground electrodes are attached the cables. One is coursed up the post of the structure to the rafters, up the face rafter to the ridge, and along the ridge to the diagonally opposite corner in like manner, and down to the second ground electrode, thus completing a ground-to-

ground circuit. To the ridge cable are attached the air terminals. These are not the grotesque, highly-trimmed, 5-ft. and higher ones of bygone days, but neat, almost invisible, substantial units, each consisting of some form of saddle and a 10 or 12-in. copper bar joint. When this portion of a system is installed, which is practically identical with a completed system of years ago, the most important portion of the system still remains to be installed, the interconnections.

Practically all buildings today are equipped with running water, necessitating the interconnection of the water pipe at its point of entry, and in addition the vent stack or stacks on the roof, all metal eaves, down conductor pipes, door tracks outside and inside, hay carrier tracks, ventilators, litter carrier tracks, electrical, radio, and telephone grounds, etc., and any such masses of metals as may be bodies of either inductance or conductance.

Why interconnect all of these metal masses? Because each and everyone of them becomes charged, and unless these bodies are brought to the same potential as the lightning protection system, a side flash can and does occur, frequently damaging and perhaps destroying the so-called "protected" building, and leaving the impression that lightning protection may fail to protect.

The most important of these interconnections is the water system, for the reason that it passes through the earth, often for a considerable distance, gathering negative charges and carrying them into the building. If this water pipe is not connected to the lightning system, such charges may and do become sufficiently dense to cause the positive charge to follow the lightning-protection cable to a point where the density is great enough to arc through the walls of the structure, causing fire or shattering.

If the resistance at this point is such as to create high heat, a fire will result. Otherwise only shattering may occur, and perhaps injury or death to persons or animals in contact with the water pipes. Only in recent years has running water been generally installed in rural areas; hence the reason why the majority of lightning protection systems previously installed are incomplete today.

Metal hay carrier tracks are the next most important item to be interconnected with the lightning protective system. There are still many wooden hay carrier tracks, but they are gradually being replaced by metal, and few farmers realize the need to interconnect this dangerous item to the lightning protection system.

Modern ventilating systems should be interconnected both at the intake and exhaust. Other

important interconnections include door tracks, both inside and outside, litter carrier tracks, eave troughs, down conductor pipes, as well as milking machine pipes. A side flash may occur to a grounded conductor from any one of these, and while they may not always be in close proximity to the lightning protective system itself, they may be very close to a water pipe, ventilator intake, or any other conductor already interconnected to the lightning protective system. Hence a connection must be made between such items and grounded conductors to provide absolute safety.

With the improvements in our construction methods for farm buildings, and work simplification in and around them, the simple lightning rod of grandfather's day becomes an engineering problem, one that demands installation by a qualified technician.

With these complexities in mind, you may ask, "How can I be sure the lightning protection I plan to install or to recommend will give 100 per cent protection?"

There is now only one positive assurance. That is to insist, before investing one penny, that the installer supply an Underwriters' Laboratories master label on the completed installation. The Underwriters' Laboratories have prepared a "Code for the Protection Against Lightning" that is in conformity with the National Fire Protection Association, the U. S. Bureau of Standards, and the National Electrical Code. This lightning protection code sets the standards for master label installations.

On completion of an installation under their master label service the installer fills out a report, which must be signed by the property owner attesting the depth of the ground electrodes. Also signed by the installer, it is forwarded to the manufacturer of the equipment for his signature, and then it goes to the Underwriters' Laboratories for issuance of their master label. This master label is then mailed to the manufacturer and is forwarded by him direct to the property owner.

Further than this, the Underwriters' Laboratories maintain a crew of inspectors in the field and inspect at random not less than 30 percent of each installer's work each year. Should any system show deficiency, a 100 percent inspection of that installer's work is made and he is required to return to the installations and without charge make any corrections they may require. Should he refuse he is suspended, and the manufacturer involved is held responsible for the correction of the work, or he, too, is subject to suspension.

The records of the Underwriters' Laboratories, during the twenty-four years they have accepted lightning protection, show a remarkable history. More than

103,000 master labels have been issued, and only a fraction of 1 percent of all of these labeled installations have shown even the slightest damage. On investigation of these damages, it has frequently been found that they were caused by the addition of equipment that should have been interconnected, or the erection of additions, chimneys, etc., and the failure of the property owners to notify the installer of the lightning protection equipment of such changes or additions.

The most satisfactory material for lightning protection systems, for physical and chemical properties, for dependability and permanence, as well as conductivity, is pure copper cable. With it should be used driven ground electrodes, adequately strong copper bronze or stamped copper clamps and connections, preferably of the screw type, or pressure clamps capable of holding the resistance down to a minimum.

The resistance of a driven ground electrode should at no time exceed 25 ohms, and on the completed system be even less. In good moist earth conditions the resistance for a ground electrode is frequently less than one ohm, and in such instances readings on a completed system often show 2.5 ohms or less.

I would emphasize two things: First, know your installer. Second, insist on an Underwriters' Laboratories master label on the completed installation before investing any money. Thus you may have peace of mind in knowing that livestock, and buildings will be safe from the menace of the sky. The fully protected structure is one which never reveals its need for protection.

Antibiotic Fights Scab

The Wisconsin Experiment Station in greenhouse tests found an unidentified antibiotic substance produced by a species of mold which proved effective in protective sprays against apple scab. There was no injury of apple, tomato or pea plants when the antibiotic material was carried in 25 per cent ethanol in water or in water alone.

With the more effective of these preparations complete control of apple scab and tomato early blight was obtained. Artificial rain tests also showed that the active material of this antibiotic actually resisted washing on foliage.

—New Jersey Farm and Garden

Fence Ends and Corners

Condensed from Iowa Farm Science

Henry Giese

Good ends and corners are the key to strong fences. Every end and corner post that isn't holding its own means a sagging fence, and, most likely, some munching visitors in the corn patch when they're least welcome. It will pay you to have good fences. Here are some hints on how to build them—with the least possible work.

Set corner posts and end posts good and deep. Increasing your depth from 2½ to 3½ feet will nearly double the strength of the post.

Long braces hold better than short ones. But double span bracing is still better. Bracing two sets of posts is less work than anchoring your corners.

Run the top wire high enough to keep livestock from leaning on the wire.

Use a few more posts, closer together, and put less tension on the wires. You don't have to use large posts; small wooden or steel posts will do the job.

Don't drive staples all the way in. Let the wire stretch without pulling on the post.

Don't overstretch the wire, especially woven wire.

Making your post hole deep enough is the key to solid corners and ends. Here is one place where it doesn't pay to skimp on your labor. By doubling the hole depth, you get four times the firmness in your set. As a general rule, however, setting your corner post to a depth equal to 10 times the diameter of the post will give you a fair balance between the strength of the post and the resistance of the soil.

If your post is set fairly deep, wet weather won't soften the soil enough to loosen your set. Deep-set posts won't be loosened up by freezing and thawing at the ground level, either.

Using extra large posts doesn't increase the strength of your corners much. They may last longer before rotting off; but a good-sized, treated post will do very well. Use a 6-inch post for the corner and 5-inchers for the two next to it. They should be about nine feet long.

Two forces are at work on any end or corner post. One is the pull of the wires above the ground; the other is the resistance of the dirt below the ground. Those top wires have a lot of leverage, and any stress on them tends to rotate the post around its lower end.

Reprinted from Iowa Farm Science, Ames, Iowa.

This means that the post is being pulled over sideways and out of the ground at the same time.

And it takes good building to keep corner posts standing straight for the life of the fence. Single span bracing, though common, seldom gives the needed strength. Lengthening the braces adds more strength; but long braces are apt to buckle. Too short braces tend to raise the post out of the ground.

Lots of farmers are doing a good job with single span bracing by fastening lugs on the bottom of the corner posts. Others are doing it by anchoring posts to "deadmen" with heavy wire. Either one of these methods does a good job; but they both require a lot of digging.

We found that by proper double span bracing we could do as good a job with less work. It took us about eight man hours to build a fence corner when we buried lugs on the bottom of the posts. Using a double span brace, we could do the job with 4½ man hours.

To get good, solid bracing run a brace from the top of the end post to the top of the second post; then run another brace from the top of the second post to the top of the third. There are several good combinations for doing this. Any of them will give you stronger ends or corners than a one-span brace from the top of one post to the bottom of the next.

Another method worked quite well in the laboratory. We haven't tested it in the field yet, so we are not in a position to recommend it. But you may want to try it if it sounds good. We used a double span, cross-braced. We ran wood braces from the top of the end post to the ground line of post No. 2, and did the same thing from post No. 2 to post No. 3. For cross braces we used three double strands of No. 9 wire. Then we stapled the wire tight to post No. 2, leaving the end or corner post fairly free of stress. It then served as a reinforcement for post No. 2. This type of construction rated 60 percent better than the double span braces just described.

Whether it will be practical for you to use double span construction will depend on your individual fencing problem: the kind of fence, soil type, length of fence and the degree of permanence desired. If you want a good fence, however, it will pay you to take extra pains with your end and corner construction. Good materials and good workmanship are necessary. A little extra time, a little more work, more careful fitting and setting may pay big dividends in better, sturdier, longer-lasting fence.

It isn't much of a job to replace a post or two in the center section of your fence. But if one corner post goes out, you'll probably have to restretch the wires or rebuild the whole fence.

Every good cow knows on which side of the fence the grass is greener. A fence that is too low invites her to reach for that juicy mouthful on the other side. Set your top wire high enough to keep livestock from leaning on it. Then your wires will stay taut, and your fence will last longer.

And that top wire has a lot of leverage behind it, too. That's why it helps to use as little tension as possible on the wires. By using a few more posts with shorter spans between them, you can reduce the tension on the wires and still have a strong, tight fence. This will keep down the side-pull on the posts when any extra load is put on the wires.

Driving staples in just far enough to leave the wire loose in the staple will help, too. Then any extra load will be distributed to several posts instead of loosening up the two nearest ones.

Many farmers take the "life" out of their fences by stretching wires too tightly. This is especially common in the case of woven wire fence. Woven wire fence is manufactured with "tension curves" (small bends in the wire) built into it. These permit your fence to shrink in cold weather and expand in hot weather without sagging. If you use a tractor to pull your fence tight, don't pull too hard. When those tension curves are straightened out, your fence loses its ability to "take up slack" in warm weather. Don't stretch woven wire as tight on a hot day as you would on a cold day.

Barbed wire has no tension curves. And for this reason it is harder on the posts. This is especially true for the top wire because it has the most leverage. A strand of barbed wire 160 rods long will expand or contract one-fifth of an inch every time your thermometer moves up or down one degree. This constant change in length puts added stress on fence-ends and corners. (Placing some kind of tension spring at intervals in the wire might be the answer to this problem.)

Iowa farms are built around fences. Intensive farming, crop rotations and a lot of high quality legume pasture make good fencing pretty important. We didn't count them, but there must be at least four million fence-ends in Iowa. And a lot of them are looking for something to lean on.

Most Iowa farms have over $500 (depreciated value) invested in fences. At present prices it would cost close to $1,500 to replace them. Right now a little extra work in the right place will pay. It will keep your fence standing up longer and will cut high replacement costs or use of scarce labor for repair.

Fences are only as good as their corners and end posts.

Big Ears Mean Less Corn

Condensed from Capper's Farmer

R. L. Foster

DON'T be ashamed if your corn ears run small. If they weigh close to half a pound each that's a sign you are getting all the corn your land can grow with the fertility it has. Maybe you should not be too proud, either, if the ears are whoppers, running 12 to 16 ounces apiece, because they indicate that your yield is lower than it should be.

Big ears look good to the hand husker, and they make a nice exhibit in the bank or hardware-store window. But they don't mean a thing so far as yield is concerned, except that probably you planted corn too thin to get the most bushels. A half-pound ear may not make such a good show, but it is evidence that the number of stalks on the ground was right for the amount of plant food available in the soil.

Thick planting plus fertilizer made W. O. Tranbarger, Grundy county, Iowa, state champion in the 10-acre contest in 1945 with 131.8 bushels an acre. Using the same methods he averaged 162 bushels in 1946—good enough for third place.

"We plant it thick—4 kernels to the hill. Hills are 28 inches apart in 38-inch rows. We have good land, we give it additional fertilizer, and we want enough seed in the ground to get a full yield," says Tranbarger. His son, who farms nearby, said: "Dad has changed his ideas on corn growing. He used to like big ears. He had to husk by hand and you can't blame him for that. He knew he had fertile land and thought no fertilizer was needed. Now he knows that generous use of fertilizer will step up production on fertile land if you thicken the stand to take full advange of the fertility.

"I like big ears, too, but I like a full crib better. I could get big show ears if I planted 2 kernels to the hill, but I plant 4 kernels because there is more grain on 4 small ears than on 2 big ones. Smaller ears dry faster and not so many are bumped off by the picker."

Legumes in rotation, manure and commercial fertilizer are the soil builders on the Tranbarger farms. All lots are concreted. Manure is scraped up with tractor loaders and hauled out every day

Reprinted by permission from Cappers Farmer, November, 1947, Topeka, Kansas

that weather permits when stock is lotted. Liquid manure is saved with a tank-bottom spreader. Tranbargers feed as high as 5,000 bushels of corn to hogs on pasture in the fall. Corn is spread evenly so hogs will do a good job of scattering manure.

Experience of the Tranbargers checks out with experiment station tests on rates of corn planting. Corn Belt stations have concluded that a lot of farmers aren't planting corn thick enough to get the best production out of their land. Rate of planting becomes more important with the growing use of commercial fertilizer. Full benefit of fertilizer isn't obtained unless there are enough stalks in the row to use it.

The half-pound ear is evidence of peak production in tests at 3 experiment stations — Iowa, Illinois and Indiana. In 2 tests at the Pennsylvania station, ears weighed six-tenths pound when the yield was highest. Another key to top yield is few stalks with 2 ears. When the combination of plants and fertility is right to get the big yield, the half-pound ear will be alone on the stalk.

Good soils, even without fertilizer, will give better yields with thicker stands. At Iowa station adding 1 stalk to the hill, or 4,000 an acre to the average stand made 8 to 16 more bushels an acre. When fertile Iowa soil has plenty of moisture, the highest yield can be expected from around 15,000 stalks to the acre.

When fertilizer is applied to Iowa soil, the stalks can be increased still more. On plots receiving 600 pounds of 8–8–8 fertilizer, production was 109 bushels at 10,000 stalks an acre. It went up to 137 bushels when the stalks were increased to 17,600 an acre.

Where the yield was highest, both on fertilized and unfertilized ground in the Iowa tests, ears averaged just slightly over half a pound. Ears averaged three-fourths pound when production dropped below maximum.

On medium soils in Illinois, more corn can be expected at 3 stalks a hill or 12,000 an acre. On highly productive soils, the best rate is 16,000 stalks. Ears averaged 1 to the stalk and weighed slightly less than half a pound in the top yields on both medium and rich soil.

Indiana Experiment Station also reports best corn where the rate of planting produces ears averaging about half a pound. If ears weigh more than half a pound, the stand was too thin. One ear to the stalk is also considered a mark of peak production by the Indiana station. If many stalks have more than 1 ear, the stand was also too thin.

At low planting rates no increase was obtained by the use of commercial fertilizer in Pennsylvania tests. The station got 61

bushels on medium soil on both fertilized and unfertilized fields when only 7,000 stalks an acre were left. Without added fertilizer the peak yield was 68 bushels at 11,000 stalks. When 600 pounds of 10–10–10 fertilizer were applied, however, yield went up as the stand was increased and reached a peak of 82 bushels at 16,000 stalks.

Small ears apparently have no bad effect on grain quality. Shelling percentage of corn in Illinois tests last year was 1 point higher for the half-pound ears than the 12-ounce ears. Neither did the size of the ear affect the shape of the kernels.

Number of stalks on the ground seems to have more effect than how the corn is planted. However, checked corn outyielded hill dropping in 1945 and 1946 at the Illinois Experiment Station. Indiana Experiment Station agronomists find that drilled corn will outyield hill-dropped corn with no fertilizer, when the same number of kernels are planted. Fertilized plots yielded more when the corn was hill-planted and the fertilizer was placed in the hill than when the corn was drilled and fertilizer was placed in the row.

Increasing the stalks carried some hazards. If the season turns dry, thick planting may cut yields severely. Agronomists feel that 15,000 stalks an acre in the Corn Belt is enough for normal years. The exact number for top production depends on moisture, soil, fertility, and the variety planted.

A definite rate of planting for a specific fertilizer treatment hasn't yet been recommended. But best results seem to come at around 16,000 stalks an acre on good land and at 12,000 on medium land.

Four stalks to the hill, 40 inches apart, in 40-inch rows comes to 15,680 an acre. Allowing for normal losses of plants, 4 kernels to the hill should produce from 12,000 to 14,000 stalks an acre, which is thicker than usual farm stands. A practical rule suggested by the Indiana station is to plant a kernel to the hill for each 20 to 25 bushels an acre the land is capable of producing.

Plowing under legume sods in rotations is a general practice in maintaining high corn production. Use of commercial fertilizers on corn is increasing. Growers generally, however, are not putting enough stalks on the land to use this fertility, agronomists say. Unless you have experimented with your land to prove otherwise, chances are you can increase your yields by planting more stalks to the acre. You will know that you are getting close to the top when the ears average half a pound apiece.

Revolution Hits the Barnyard

Condensed from Nation's Business

John A. McWethy

DROP in at an average corn belt farm. You'll find it powered by tractors. They enable a man to do seven times as much as he could accomplish with animal power. Yet there'll be a big 50 year old red barn with stalls for long-gone horses and plenty of mow space overhead for hay to feed them.

If it's autumn, this farmer will be harvesting corn with a mechanical picker that permits him to do ten times as much as he could have accomplished by hand 20 years ago. And he'll raise five bushels where he got four a decade ago because he's using hybrid seed. But he will store this corn in an ancient crib built by his grandfather where rats make themselves at home and eat 20 percent of the supply before it can be used.

The same farmer will milk his cows by machine in half the time it took him when he did it by hand. Yet, the chances are he'll store his baled straw in a building someone put up years ago that is so far from his dairy barn that he'll have to walk an extra mile daily getting material to bed down the animals.

The plain truth is that farm building construction hasn't kept pace with improvements in machinery, seeds and fertilizers. D. M. Malcom, manager of marketing services for the American Rolling Mill Company and executive secretary of the Farm Structures Institute, asserted recently:

"Farmers are using the methods of their sons, but the buildings of their grandfathers."

A revolution is brewing, however, that's going to result in a lot of changes in the rural landscape. Farm buildings are going to be modernized. New designs, construction methods and materials are being developed and tested. A few are already beginning to show up on farms.

To the man who owns or operates a farm, this rural upheaval offers a new crop of money-making opportunities. The upheaval will open ways to cut labor costs, use machinery more efficiently, reduce fire losses, and trim damage losses to stored grain.

Drive out in the country ten years from now and what changes will you see? There will be one-story fireproof barns that never

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will need repainting, glass-lined silos that will unload themselves, "lounges" for dairy cows that will make them so contented they will give more milk than ever before.

You'll see more steel and aluminum used in building construction. Other structures will still be constructed of wood, but treated so as to resist rot and fire.

The prefabricated buildings used in increasing numbers for city houses are expected to play an even more important role in the country.

One of the biggest changes is slated to come in barns. An old objection to the wooden barn has been that it was a fire hazard. Spontaneous combustion in hay mows has been the biggest single cause of farm fires. When hay stored above animals catches fire, it also often means livestock losses. The nation's farm fire losses run to more than $100,000,000 a year.

So, the old-fashioned barns for housing dairy cows may be replaced with one-story "milk factories." Constructed of steel or cement, interiors will be as different from predecessors as exteriors. Instead of being confined to stalls in winter, cows will stand in so-called lounges. They will be milked in "parlors" equipped with milking machines. There will be a sufficient number of stalls to handle cows in small groups.

What's going to happen to that sweet smelling hay that now goes up into the mow? Some of it will be stored in a new type of steel building that its producer, the Martin Steel Products Corporation, calls a "haymaker." The haymaker has about twice the diameter of an average silo, has perforated walls. This makes it possible to force air through the hay and dry it artificially.

For many years farmers have cut hay, allowed it to dry in the field and then stored it in mows. In a year of heavy rainfall farmers have lost more than 50 percent of the crop through leaving it in the field. Recently, however, a new machine has been developed—the forage harvester. This machine chops the hay into small pieces and blows it into a wagon. It is then ready for the haymaker and speedy drying.

Crop losses from wet weather are thus reduced. Labor costs may be cut as much as two thirds. Less storage space is needed because chopped hay takes up only one third as much space as loose hay. Artificially dried hay also has a higher feed value. Leaves fall off field-dried hay before it reaches the barn. The leaves are more appetizing and contain more vitamins and minerals than the stems.

For farmers who bale their hay, building experts suggest the use of a general purpose one story building for storage. An all-purpose structure of this kind also may be used to store machinery, wheat,

extra feed or other farm equipment.

Significant changes also may take place in the old silo. One change would remove possibility of accidents. Most silo mishaps occur in winter when farmers are compelled to work on icy, slippery steps to chop ensilage loose. A false step may mean a fall of 30 or more feet. In a new type of silo developed by the A. O. Smith Corporation there is no need to climb—one need only push a button at the bottom and out comes the ensilage onto a moving belt that delivers it to the livestock. In addition to the unloading device, the silo has a glass lining fused to the steel exterior. The glass isn't affected by ensilage acids that eat their way into cement and wood. The silo is expected to be placed on the market next year.

Other crop storage buildings are going to undergo change. Old wooden corn cribs, with air spaces between the side boards, are still used on many farms. Where the government stored corn in cribs of this type several years ago, losses up to 50 percent from rats and mould were reported. Now ratproof steel storage units have been made available.

A steel unit is being tested at Purdue University that utilizes a portable heater to dry corn. The heater is similar to one used to warm airplane engines in the Arctic during the war. If this type of drying and storage unit pans out, it may become possible to shell corn as it is harvested in the field. This can't be done now because corn contains too much moisture and is left on the ear, where it dries faster.

Shelling corn as it is harvested also would make it possible to use a later maturing variety, thus boosting the yield. Still another advantage is that less storage space would be required.

Hogs are expected to live better on farms of the future. One company is experimenting with an all-steel hog house with hinged roof that may be lifted like the hood of an automobile, thus providing greater ventilation and sunlight. Another firm is making a six-sided "pig nursery" equipped with a heating unit that will permit farrowing without heavy loss of pigs due to cold killing them. This nursery also will have an escape chamber for young pigs that otherwise might be crushed by having the sow lie down on them.

Buildings will become more flexible, too, thus lending themselves more readily to changing conditions.

Elmer F. Clark, sales engineer for the Butler Manufacturing Company, cites the case of a farmer who has been raising poultry in a sectional type of steel building 70 feet long. He wants to raise fewer poultry, shift to hogs. So he buys two more ends, divides the

building and starts raising hogs in the newer section. He will be much better off than a neighbor who is using old horse stalls in a two-story barn for hog farrowing.

Farm homes won't be left untouched by this coming revolution. Many are in need of modernization. The census of agriculture taken in 1940 showed that fewer than 20 percent of rural farm homes had running water, others lacked bathroom and indoor toilet facilities. For those who own farms but don't work them, improved living conditions will lead to more satisfied tenants.

There is room for improvement in the location of farm buildings and in their interior arrangements. On many farms, buildings have been erected here or there as the need arose, with no thought of efficiency. A number of time and motion studies made recently by agricultural engineers showed that better location and arrangement of buildings could mean a large saving in time and money. For example, Purdue University applied the results of time and motion studies made on Indiana farms to hog house design. It was revealed that it took a labor expenditure of only 1.7 man-hours to raise a 225 pound hog, while the average Indiana farmer worked five to seven hours to make marketable a fair-sized hog.

One suggested improvement was to put all farm work buildings under one roof. This plan was advanced by Frank Reynolds, in charge of agricultural extension work for Carnegie Illinois Steel Corporation. The latter concern and the University of Wisconsin's College of Agriculture are cooperating on a project to determine the merits of various types of farm structures. Advocates of a single unit point out that time now wasted walking between buildings would be saved, and that such a structure would be cheaper to build.

The cost issue is a prime factor to farmers today because lumber prices have risen to where steel and aluminum are able to compete. Wide publicity given the quonset hut during the war is helping to sell steel to farmers. Many quonset huts are being used to house livestock and for the storage of machinery and crops, and as general utility buildings.

Aluminum's largest use on farms is for roofing. An aluminum roof costs slightly more than steel, but lasts longer and has the advantage of deflecting heat. A mail order house in Chicago that sells such roofing says it makes buildings as much as 15 percent cooler on hot summer days.

There are going to be changes, too, in farm building construction methods. The farm market is ideal for prefabricated houses, barns and other buildings. Identical buildings, often frowned on by city

dwellers, are accepted in rural areas where farms are so far from each other that it makes no difference. When it comes to structures other than a farmer's home, the main consideration is a design that will permit the most work for the least money.

The farm also is a fertile field for the prefab from a labor point of view. Prior to the war, if a farmer wanted a little building done he went into the nearest town and hired the local carpenter. High factory wages in the city during the war and even higher building pay now in urban areas have drawn off many of these carpenters. Thus a small house that can be put up by the farmer himself, or a larger one that some firm will erect for him, is going to be received warmly.

There are approximately 75 firms making prefabricated farm buildings. The price ranges from a few dollars for a single unit up to $20,000 for metal barns.

Among those selling prefabs are lumber yards, cooperatives and mail order houses.

While much has been learned about farm building in the last few years, research promises many new things for early marketing. Building material firms, agricultural schools and the Government are all participating in this accelerated research on farm structures.

At one extreme is the new government-sponsored experiment at Columbia, Mo., where there's a two-chamber cow barn. One half is air conditioned, the other like an ordinary barn. By varying temperature, humidity, light and other conditions and comparing the milk output of the two groups of cows, researchers hope to learn the worth of new methods of insulation, ventilation and other related factors. At the other extreme are projects such as the one Republic Steel Corporation has on its 500 acre field laboratory near Paris, Ky., where it is testing steel in buildings typical of those found on ordinary farms.

Wallace Ashby, in charge of the Department of Agriculture's division of farm structures, estimates 7,000,000,000 man-hours of work are now required in and around farm buildings, or about one third of all farm labor requirements. "Much of this work," he says, "could be eliminated with proper design of buildings and farmsteads. Certainly it should be possible to save 1,000,000,000 man-hours of this time each year."

On the basis of need alone, farm building could total $2,000,000,000 a year for ten years. It isn't expected to reach that high, but the Producers' Council, the national organization of building material makers, believes the next few years will bring the strongest market for farm building products that this country has ever known.

Farmers spent $450,000,000 annually for new buildings and for maintaining and modernizing old structures in the five years prior to the last war. They spent about $750,000,000 in 1946. Frank Piovia, economist and market analyst for the Producers' Council, estimates the total will reach $1,000,000,000 this year. In 1949–51, he predicts it will top $1,250,000,000 annually, almost triple the prewar sum.

Twenty Cows and 200,000 Pounds of Milk per Man Each Year for Top Production

Condensed from the Herd Builder

J. D. Burke
Cornell University

Assembly line production has helped industry achieve mass production. It has resulted in increased labor efficiency, greater production volume and lower costs that are just as important on the dairy farm as they are in industry. Perhaps milk production can also be put on an assembly line basis.

Labor efficiency on the dairy farm must keep pace with that in industry if the dairy farmer is to compete with industry for labor and to meet higher wage rates. The best over all measure of labor efficiency on the dairy farm is yearly milk production per man. It is possible to get 200,000 pounds of milk per man each year if full advantage is taken of all the factors involved in getting maximum efficiency. The following table gives standards of efficiency and an analysis of the amount of work involved.

High production per cow and 15 to 20 cows per man are absolutely essential in order to achieve the higher levels of efficiency. Production per cow is determined by methods of breeding, feeding and management. Cows per man is determined by size of business, crop yields, methods of doing the job, use of labor-saving devices, and farm and barn layouts.

A study of the materials that must be handled to produce the feed and care for a 20 cow unit shows that upwards of 600 tons of materials must be lifted by hand each year. Much of this material such as hay, silage and manure

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LABOR EFFICIENCY ON THE DAIRY FARM

Work performed per man	*Efficiency rating*			
	Excellent	*Good*	*Fair*	*Poor*
Number of cows	20	17	12	10
Capacity of cows (Milk Pounds)	10,000	9,000	8,000	5,000
Number of replacements (youngstock)	15	12	9	7
Raw materials				
Hay (tons)	60	45	30	25
Silage (tons)	90	70	50	40
Bedding (tons)	25	20	15	10
Grain (tons)	37	26	16	6
Pasture (acres)	30	25	20	15
Finished product—milk (cans per year)	2,500	1,875	1,250	675
(cans per day)	6.4	4.8	3.2	1.6
By-products—manure (tons)	300	230	125	100
Available to pay labor*	$2,000	$1,500	$1,000	$500

**Assuming an average price of $4.00 per hundredweight for milk and that 25 percent of this return can be spent for labor.*

may have to be lifted and sometimes carried as many as four times at the end of a fork. Add to this the miles that must be walked each year. The amount of work is amazing. Yet it may be easier to care for a twenty cow unit with efficient methods and labor saving equipment than to care for a ten cow unit with inefficient hand methods.

Assembly line methods and machinery must take more of the *lift,* the *carry* and the *walk* out of the dairy farm business. The dairy barn becomes the assembly point on the dairy farm. Modern machinery has already taken much of the lift, carry and walk out of growing, harvesting and storing the raw materials. Hay, silage and concentrates must be stored near the assembly line in close proximity to the point where they are to be used.

Work in the barn makes up more than 50 percent of the labor of producing milk. Dairy barn arrangement, barn equipment and methods of feeding and milking offer the greatest opportunity for cutting labor costs. Feed moved by gravity and feed carts are taking the lift, carry and walk out of feeding. Milking machines double labor efficiency. Use of a milking room and a pen stable is one of the newest assembly line methods of bringing the work to the man in order to cut the lift, the carry and the walk.

Manure is the biggest single item of weight that has to be moved. Three hundred tons of manure at the end of a fork or shovel is a lot of weight. Spreaders have cut the lifting in half. Power loaders are here and mechanical gutter cleaners are coming along to eliminate the other half.

A two- or three-man unit can in most cases be operated more efficiently than a one-man unit. Nevertheless, each additional man must handle 15 to 20 cows and turn out 150 to 200 thousand pounds of milk per year if present high labor costs are to be met.

The Hen That Lays Is the Hen That Pays

Condensed from the Rural New Yorker

G. T. Klein

FIVE-dollar feed is driving home some fundamental facts about poultry keeping. When the egg checks fail to do more than pay for the keep of the flock, it isn't long until sharp pencils go into action to find the reason. A few records and a little figuring have caused many a poultry keeper to sell a flock during the past eight months. It has caused a tremendous swing in chick orders to the highest production stock obtainable.

The feed consumption of flocks varies with the size of the bird and certain other factors. It runs something like this: 22 to 24 pounds a day to 100 birds for body maintenance; 28 to 30 pounds for 50 percent production; 32 to 34 pounds for 60 to 70 production; and 34 to 36 pounds for 70 to 85 production. In these figures is the explanation of the necessity of high production for profits in times when the ratio between feed costs and egg prices is narrow. Requiring 28 to 30 pounds of feed to produce about four dozens of eggs, the high producing flock gives about three more dozens of eggs for an extra six pounds of feed. That is where the profit is to be found.

These figures are substantiated by the dozens of poultry keepers who have had to sell off flocks because they couldn't pay their way at 40 to 50 percent production during the past months. And the worst is that there is not much chance for poultry feed to be cheaper or egg prices to be greatly higher during the immediate months ahead. This means that it is going to take more than a 40 to 50 percent lay to make money keeping poultry.

Scientific breeding has done so much for breeds and strains in increasing egg production that it is fairly easy to get pullets that can lay at a profitable rate. There are three or four inherited egg-laying characters which all strains must have if they are to give a profitable rate of lay over a period of months. Such characters as a high rate of lay, low broodiness and late Spring and Summer production at a high rate are easily found in the egg strains, but are lacking in the best broiler birds. If the selection of stock is wrong, there isn't much that feeding and management can do to correct it. On the other hand, a flock that has

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333 West 30th Street, New York City

the right breeding back of it can be rendered entirely unable to perform in keeping with its inheritance because of exposure to disease or mismanagement.

At the University of Massachusetts, accurate records have been kept for many years on the egg-laying ability of the breeding flock. Here a flock of Rhode Island Reds has given a yearly average production of 225 to 250 eggs to the bird without culling. F. A. Hays, poultry geneticist of the University, who has been in charge of the breeding work for the past quarter century, reports a flock average of 256 eggs for the 15 birds kept in his backyard flock in 1946 and 1947. These pullets laid for an entire year without a single fatality. The return after feed and other cash costs had been deducted was better than $6.00 to the bird. Even when feed costs are high and a flock averages 130 pounds of grain and mash as this one did, there is money to be made if production is high.

We have in Massachusetts a larger percentage of commercial size flocks than any of the 48 States. Producing market eggs is the business of the majority of these poultrymen. They are constantly looking for the highest production stock that can be found. The flocks have got to be able to carry on at 70 to 85 percent, when conditions for them are favorable. Fortunately the breeding program in the Bay State, which dates back to World War I days, has produced birds which can give top production. The State Bureau of Agricultural Economics has reported month after month an average production of about 65 percent for the 5,000,000 laying birds of Massachusetts. Their reports have, year after year, shown the average mortality for the State to be 11 to 13 percent. This high production and low mortality in Massachusetts, which the breeders have put into their flocks through scientific genetics, are of tremendous importance and are the chief reasons why it is possible to still carry on profitable commercial egg operations.

The White Leghorn has practically vanished in our State. It is not because she is not a high producer nor an efficient one. The reason is that a white egg sells at a price disadvantage on the Boston market. Then, too, the White Leghorn fowl sells at a far lower price than the heavy fowl. For practically all of New England there is every price advantage in keeping the heavy chicken.

Though I have tried to bring out that inheritance is tremendously important in determining production, it would be most unfair not to give credit to disease control and good management. The narrow margins which seem almost certain, demand more and more that full vaccinating and im-

munizing programs be followed. To be more specific, it looks foolish for poultry keepers to take a chance on fowl pox this year. It is so easy to vaccinate, so cheap and such good insurance that few can afford to skip it. Laryngotracheitis is something different. More poultrymen can take a chance on it. Perhaps, before the year is over, there will be a Newcastle vaccine for you. If it sounds reliable, use it. The scientific work looks favorable. That leaves bronchitis, the one disease which can be handled through immunization. If you live in a State where this program is available to you, don't take a chance. An outbreak of a respiratory disease in the Fall can practically ruin you financially. It does not pay to take many chances.

I am one who believes it is more important to get layers to eat a lot of feed than to get them to eat it in a certain relationship between grain and mash. I have seen about the same results from grain and mash, complete mash and free choice feeding.

You can drag out that old saw, "the hen that lays is the hen that pays," and say it over and over. If you believe it and follow it in 1948, you'll be dollars ahead.

Soil Organic Matter

My conclusions about soil organic matter are somewhat as follows:

Inorganic fertilizers are highly effective agents for increasing the amount of organic matter in soils.

The organic-matter problem is readily solved when rotation with a sod crop is practiced and lime and fertilizers are applied in liberal amounts.

Fresh green organic matter is of more value in a sandy soil than in a heavy one. Crude types of organic matter are of more value in a heavy soil than in a sandy one. Soil organic matter is of less value in soils of the intermediate loam types than in either the lighter or heavier types.

Soil organic matter is of little or no value in sand cultures in which plants are fed continuously with properly balanced nutrient solutions.

The effectiveness of sod and cover crops as agents for preventing erosion is self-evident.—DR. FIRMAN E. BEAR.

—New Jersey Farm and Garden

George Washington—Experimental Farmer

Condensed from Electricity on the Farm

James Aldredge

IF THE average American were asked to name the first important experimental farmer in the country's history, the last person he would probably think of would be George Washington. Yet the First President was also the first great pioneer agriculturist of the nation.

A farsighted citizen, he realized the importance of agriculture to the nation's future. After the surrender at Yorktown, the victorious commander made this wise observation to the men in his army: "I know of no pursuit in which more real and important services can be rendered to any country, than by improving its agriculture, its breed of useful animals, and other branches of a husbandman's cares."

Washington must have had this purpose in mind when he began his own experimenting. On his Virginia acres he set out to test every new seed, implement and method that he could get from England or other parts of the United States. Any idea that flashed into his fertile imagination was immediately tried out.

Meanwhile, his good wife Martha was just as interested in her work at Mount Vernon. Bustling about in her "speckled apron," she supervised the domestic activities on the big estate. From the great colonial mansion all the way down to the smallest of the rambling outbuildings, she passed continually, keeping a watchful eye on the spinning house, the laundry, the smoke house, the dairy and the huge kitchen. The textile work was all done under her skillful direction, starting with the spinning of the yarn and ending with the sewing of garments. There are records which prove that Mrs. Washington was just as methodical as her famous husband and no less energetic.

American agriculture was in a bad way when Washington began his experiments. Land was cheap and plentiful, but all too soon exhausted. Fields, planted to tobacco and Indian corn, soon ran out, and there seemed to be nothing that men could do about it except to pull up stakes and strike out anew.

But this was not the way George Washington farmed. One of his earliest moves was to get in touch

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with the leading agricultural authorities of his period. He opened a correspondence with two famous British experts—Sir John Sinclair, President of England's Board of Agriculture, and Arthur Young, the writer. Letters passed regularly back and forth across the Atlantic, and in this way the owner of Mount Vernon kept informed of the latest methods, grains, plants and implements that were being used on the farms of England.

Whenever Washington had an experiment up his sleeve, he would turn to his "Botanical Garden." Here, as well as in other plots, he was continually trying out fertilizers, new seeds, stands of grain, rotation of crops and the conservation of the soil itself.

Washington was very systematic in his testing of grounds and fertilizers. He would lay out a large box in ten divisions, placing within these various soils which he treated with various manures. In each division he planted three grains each of wheat, oats and barley. All were watered "equally alike, an hour before sunset." Then he awaited results, setting down what happened to the minutest detail.

Wheat was Washington's favorite crop and he endeavored to improve its quality. In the big barn at Mount Vernon there was room for thirty hands to thrash. Washington had little use for the old-fashioned method of putting horses to tread it outdoors—it seemed too risky, as the grain was exposed to the weather. His care with his own crop explains why the three mills he owned turned out the finest flour in Virginia.

Along with grain-growing Washington was a pioneer horticulturist, and the orchards of Mount Vernon became as famous as those in the Shenandoah Valley in a later day. By extensive grafting, Washington succeeded in producing fine varieties of plums, grapes, pears and apples.

As a stock-raiser, he also made a name for himself. He found the animals on many Virginia estates badly fed and poorly cared for. All this he arranged differently at Mount Vernon. After studying the methods of better breeding, his success showed in his many horses, sheep, cattle and hogs, all of improved strains.

Of all his experiments, none afforded the master of Mount Vernon so much fun as devising some new implement. Washington was possessed of real Yankee ingenuity. "She answered very well" was his report on a plow that he put together. His chief pride was a seed-drill or "barrel plow," which he invented. It would provoke smiles today, but the great Virginia farmer found it everything he had hoped for—a truly "modern improvement," as he described it!

Feathers Can Mean Extra Profits

Condensed from New Jersey Farm and Garden

Edward R. Walshaw

STRANGE as it may seem, the neck can be the most valuable part of the chicken. Fly tyers will pay fancy prices for rooster neck skins that have coloring adapted to their needs. The cured and dried skins are welcomed by any one of the many tackle companies which cater to our vast army of sportsmen. These companies will pay from 50 cents to $2.50 per skin.

In addition to the neck skins, you can make another 25 cents to $1.25 on saddle skins if your market for poultry is such that you can save them out. The highest priced feathers are from Silver Laced Wyandottes, Silver Pencilled Plymouth Rocks (crossbreeds) and Blue Andalusians. High prices can also be obtained from purebred Plymouth Rocks and certain crossbreeds, depending on the color scheme of the bird's feathers.

Here is a partial list describing the type of feathers desired by this very active market, and a general idea of the prices paid.

Plymouth Rock rooster necks: These skins must be taken from birds with good barred black and white feathers. All skins must be fully developed, with no pin feathers. This last is a "must" on all skins, no matter what the breed. Skins to include all feathers on the neck from the largest at the base of the neck to the very small ones at the comb. Prices range from 50 to 75 cents.

On mixed Plymouth Rock strains, or any crossbreeds with neck feathers having tan, cream, or white mixed with the barring, prices run from 45 to 75 cents.

Silver Laced Wyandottes, Silver Pencilled Plymouth Rocks or any crossbreeds having neck feathers white, cream, or tan, with a dark gray, brown, or black stripe running lengthwise from the top to the bottom of the feathers—75 cents to $2 per skin.

Plymouth Rock hen skins: These hens have their whole bodies completely covered with black and white striped feathers. Prices for complete skins range from $2 to $2.35.

Blue Andalusian, or any crossbreed that satisfies conditions: These feathers range from gray to dark gray with no markings or flecks whatsoever—$1.25 to $2.50.

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Other salable rooster necks are those with light, medium or dark brown feathers, with a black stripe running lengthwise—75 cents to $1.25.

Saddle hackle skins from the above breeds bring 30 cents to $1.25 per skin. These skins contain all the long glossy feathers from the rooster's back and rump. All these feathers can be plucked and saved in bags if it is impossible to save the skins. They are then sold by weight, and prices range from $2.50 to $16 per pound, depending on the quality of the feathers and the markings and breed of the birds.

Feathers are g r a d e d by the amount of "web" they contain. Web is the soft center of the feather. When held up to the light, web will be readily discernible as a shadowy outline in the feather. Feathers with the least web are the most desirable. As a rule, the older the bird the less web will be found in its plumage. Birds with hard, bright, glossy plumage will be found to have but little web.

The roosters should be killed by cutting the throat at the roof of the mouth. Hold the bird firmly so that the blood will not spatter its plumage. After it is dead, slit the skin from the base of the neck to the bill on the underside. Cut the skin off at the base of the neck, and pull it gently forward toward the head. Now cut it free, carefully saving all the small feathers on the cheeks and the base of the comb. These small feathers are important. A skin which does not have them will be graded low to worthless.

Scrape all fat off the skin, as the oil from the fat w o u l d s o a k through the skin and spoil the feathers. As soon as the fat is scraped off, place the skin in a pail of cold water containing a medium solution of salt or borax. Let them soak for two days, and then take them out and place them on a newspaper, skin side down. Place the skins together with the paper in a wood frame. Stretch them lengthwise as far as possible. Fasten in place with a couple of tacks.

Do not try to stretch the skins on a board, as the air must circulate on both sides. Let them dry in a sunny place, checking them frequently. Be sure and keep flies away. If the skins show signs of spoiling, sprinkle them with a little salt or borax. When the skins are dry, they are ready to ship.

You can find buyers for your feathers by writing some of the numerous fly tyers who advertise in all of the many sportsmen's publications. The above prices were taken from the 1947 price sheet of a large mid-Western fishing-tackle concern.

Mulch Is Good Orchard Practice

Condensed from Michigan Farmer

H. B. Tukey
Michigan State College

THE experiences of many fruit men in many parts of the country show that mulching is good orchard practice. Mulching is simply putting some such coarse material as hay under the trees in the orchard, usually in sufficient quantities to suppress or destroy weed growth. It may be a heavy mulch of 15 or even 20 tons of spoiled hay per acre put on knee deep once every 4 or 5 years; it may be the light mowings from between the rows in a young orchard pushed over by a side-delivery rake; or it may be a cutting of alfalfa which has been fertilized and grown especially for the purpose on a piece of land too rough for cultivated crops. Usually it amounts to 2 to 10 tons, about 6 inches deep. In any event the material should be kept out under the branches and not piled against the trunk where mice may be harbored and where delayed maturity of the trunk may present the hazard of injury from winter cold.

A number of different materials may be used. Along the Atlantic seaboard, seaweed is used. In other areas, pea hay, rushes, and tobacco stems have been found useful. The more strawy or woody the material, as sawdust, some peats and new straw, the more likely is there to be an initial depressant effect on tree growth and a lighter-colored foliage—especially on some of the lighter soils. This is due to the utilization of nitrogen in the soil by the microorganisms as they decompose the material. Accordingly, a little nitrogen along with such mulch is essential—say a pound or two of nitrate of soda or ammonium sulfate to the tree, depending on the color of the foliage and the growth of the tree.

In all fertilizer applications and soil management practices it is impossible to generalize within narrow limits, and mulching is no exception. We know altogether too little about the time to cut mulch, the time to apply it, and the responses from different materials. Certainly, new alfalfa cuttings differ from old hay that has been rained on and leached for several years. Where is the point at which it is not profitable to mulch? These are some of the

Reprinted by permission from the Michigan Farmer, November 1, 1947, Detroit, Michigan

questions about which we have much to learn. Yet we can say that mulch has been highly successful in both apple and pear orchards, and has seemed promising in the very few peach, cherry and plum orchards where it has been tried.

Just what does a mulch do? First of all, it checks weed growth and so conserves moisture and helps in droughty periods. It catches rainfall, prevents run-off, stops erosion. It holds snow and protects against root damage from winter cold. And for some reason, not too well understood, the moisture content builds up under a mulch even without rainfall. Some say that this is due to condensation of moisture from fluctuating temperatures in the air spaces in the mulch or soil at night like condensation of dew. At any rate, the moisture content of the soil is higher under mulch than under clean cultivation. Pears are admittedly larger in size in mulched orchards.

Besides this, the physical condition of the soil is improved. A glass tube filled with soil from a mulched orchard will let water run through it like it does through a coffee percolator, whereas a similar tube filled with soil from a clean-cultivated plot will often hold the water back for a considerable time. That is not all—soil nutrients are likely to be kept in a more readily available form so that deficiencies are less likely to appear. This is especially true of potash. And finally, if the mulch material is itself fresh and rich in nutrients, it may add some much-needed fertilizer value.

But where can this mulch be secured? Where it is? In some areas it certainly is hard to find. But, in other areas the shortage is more imaginary than real. There was a lot of spoiled hay in Michigan in 1947. In some other areas, it was possible to mow wet places this past summer that had not been touched for years. The writer once looked for mulch for a 20-acre orchard where everybody said "there isn't any mulch to be found." Well, behind the canning factory a half-mile away there were 2 tons of pea-vinery hay, and a little further down the road were 2 forgotten stacks of old, spoiled hay —enough for the entire orchard. Some orchardists have found it profitable to put that rough 5-acre piece into alfalfa, fertilize it and grow it just for orchard mulch.

Yes, fire may be a hazard in the mulched orchard. "A man has got to think about that!" Mice can cause severe damage, but with a regular baiting program of poisoned grain, or the newer zinc phosphide treatment, plus wire guards, he should have no trouble. The writer lost only one tree from mice damage from 1,500 trees in mulch over a 12-year period.

The soil conservation service

has done great good in its program to increase the organic matter in orchard soils. Mulching is one of the better ways to push the work along. And if you will take the trouble to look around you, you will find that some of the insidious and little-understood deficiency troubles that seem to be bobbing up in orchards are seldom present where a mulch program is in effect.

Green Pastures Cut Baby Pig Losses

Condensed from Ohio Farmer

Loss of newborn pigs is a major problem of the swine producer. How to cut down that loss is one of the questions being studied in the animal husbandry department at Purdue University. At the recent Swine Field Day they reported that gilts on alfalfa pasture farrowed heavier and stronger pigs than those on the regular ration, or those that were fed 15 percent of dehydrated alfalfa meal with the regular ration. The basal ration for all lots consisted of yellow corn, soybean oil meal, minerals and cod liver oil.

Gilts that were fed the basal ration, and those receiving alfalfa meal, lost almost twice as many pigs during the first three days after farrowing as were lost by gilts from the alfalfa pasture lot.

The pigs farrowed by gilts that had been on alfalfa pasture were heavier and stronger when weaned than those in the other lots.

Three gilts fed the basal ration, and one receiving alfalfa meal, lost all their pigs, while no complete litters were lost by gilts that had alfalfa pasture during the pregestation and gestation periods.

Seventy-eight percent of the pigs in the alfalfa pasture lot were weaned, while in the other two lots only 52 and 54 percent were weaned.

Mature sows that had been on bluegrass pasture during pregestation farrowed heavier and stronger pigs; they lost about one-third as many pigs during the first three days after birth as were lost by the sows receiving alfalfa pasture or the basal ration alone. The sows that had bluegrass pasture also weaned heavier and stronger pigs than those in the other lots.

The results of the study to date indicate that a majority of the pigs that die shortly after birth show pathological abnormalities which

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apparently develop during embryonic life. Enlarged and fatty livers, and swelling of the tissues and kidney damage were frequently observed.

Be sure that hogs on pasture get plenty of salt and other minerals. That is the lesson to be learned from another test reported at this field day.

Both rate of gain and feed requirement of the hogs on alfalfa pasture were improved by feeding a mineral mixture of limestone and steamed bone meal, and further improved by feeding loose salt free choice with the mineral mixture, when the basal ration was corn and soybean oil meal.

Hogs receiving the mineral mixture gained one-fifth of a pound more a day than those without it. By feeding loose salt free choice with the mineral mixture, the average daily gain was further increased more than one-third of a pound.

For each pound of salt consumed there were eight pounds of extra gain, and a saving of $1.40 worth of feed. The average daily consumption of salt was two-thirds of an ounce a hog, which was more than was eaten by hogs on a similar ration in previous dry-lot experiments.

Hogs without salt ate 17 times as much of the mineral mixture as those receiving salt free choice with the mineral mixture.

The hogs without minerals did more rooting of the pasture than was observed in the other lots. These hogs had a thrifty appearance and gained uniformly. It would have been difficult to realize their low level of efficiency without the comparison with the others receiving salt and the mineral mixture.

How much extra salt is needed will depend upon the kind of supplement. Twice as much salt was eaten with the vegetable protein supplement as with one containing 45 percent of meat and bone scraps.

Hogs fed a vegetable protein supplement ate .56 of an ounce of salt a head daily, while those receiving the supplement containing meat and bone scraps ate only .28 of an ounce. The soybean oil meal contained .05 percent salt, and the meat and bone scraps, 1.0 percent.

In the lots without salt, the hogs receiving the vegetable protein supplement ate twice as much of the mineral mixture, for an equal gain, as was consumed by those getting meat and bone scraps in the supplement.

The free-choice feeding of loose salt seems to be an efficient method of correcting salt deficiences of hog rations, regardless of the kind of supplement fed.

Another test was designed to study Sudan grass as a late summer pasture. Alfalfa pasture increased the gain of the hogs 8.7

percent over those fed in dry lot. The increase with Sudan grass was 2.1 percent. Compared with dry lot feeding, alfalfa pasture saved 6.4 percent of the corn and 22.3 percent of the protein supplement. Sudan grass saved 2.7 percent of the corn and 18.1 percent of the protein supplement. A minor saving of salt and other minerals was the same for the two pastures.

On the basis of relative feed cost of gain in the dry lot and pasture feeding, alfalfa saved 2.5 cents a hog daily, and the Sudan grass, 1.4 cents.

With a pasture value of 2.5 cents a hog a day, an acre of good alfalfa, which will graze 20 full-fed hogs with a protein supplement, would be worth $15 a month. Sudan grass would have to graze 36 similar hogs an acre to be worth $15 a month, on the basis of its saving in the feed cost of gain in this experiment.

The carrying capacity of the Sudan grass was not determined because of the excess of growth in the lot. It was necessary to clip the crop twice during the experimental period. Observation of the experimental hogs, and others, grazing Sudan grass indicated a very heavy carrying capacity for this crop.

How Marsau Makes Pigs

Condensed from the Farm Journal

WILLIAM MARSAU starts "feeding" every litter of his pigs long before they are farrowed—even before, and quite awhile before, the dams are bred.

That's worth knowing, along with just how he does it, for William Marsau raises and markets *more pigs per litter than any other farmer in Iowa.* He and his son, Robert, operate 120 acres in Black Hawk County. (Incidentally, they have 35 Guernsey cows that gross $1,000 a month, too.)

Last spring Marsau's 15 sows farrowed 203 pigs. That was more little suckers than teats, so 36 were disposed of, and seven given to a neighbor. One hundred and sixty, or 10⅔ to the litter were weaned. The previous fall, these same 15 sows, as gilts, raised 120 pigs. Earlier in 1946 the Marsaus raised and sold 145 spring pigs from 15 sows.

For more than five years they have averaged more than nine pigs to the litter, twice a year, weaned,

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raised and marketed. They always farrow 15 litters in early fall and 15 litters in early spring.

Mr. Marsau and Bob use fall gilts for August farrow. They breed them back to pig in late February and early March, then smooth them up and fatten them for market. This year the 15 sows were sold weighing an average of 561 pounds four weeks after they weaned their spring litters. The shoats are marketed at about 5½ months, weighing around 230 pounds.

But how do they "feed" pigs before their dams are bred? By feeding the gilts or sows just right (not over-feeding), to make sure the pigs have every chance to make hogs of themselves right from the moment of breeding.

That's starting early enough, but the Marsaus start even a little sooner. They consider the brothers and sisters, and the motherly qualities of their dams, when they pick the breeding gilts. And they select these gilts when they weigh about 140 pounds and are stilll growing. Then the gilts are *shut away from the fattening shoats* and kept away. They stay on growing ration.

Finally, in this process of "feeding" the Marsaus flush the gilts or sows for three weeks before breeding by stepping up the protein in their ration to put them in the pink of condition to settle in pig. They like linseed oilmeal for this.

The sows have the run of the farm during gestation, winter and summer; are sheltered in A-houses and are fed alfalfa hay, oats, and corn. Ten days before a sow is due to farrow the corn is stopped, and the alfalfa hay reduced by two thirds. Three days before she is due the sow is shut in the farrowing pen to get used to her quarters and her keeper.

For three days after farrowing she gets no feed but buttermilk and water. Then she is started on bran and oats, and about a week later corn is resumed. By the second week, the sow is on full feed of corn, oats, and protein supplement. That isn't varied until the pigs are weaned.

Just as soon as the pigs will take solid feed they are creep-fed a mixture of rolled oats, cracked corn, alfalfa meal, and meat bone meal. Later ground oats is substituted for rolled oats. The fattening ration (after shoats reach 140 pounds) is mostly corn and tankage.

Both early spring and fall pigs are fed dirt. The Marsaus are particular about this "feeding dirt." They cut fairly thin strips of bluegrass sod with plenty of roots in it. Then they "cure" the sod. They want it dry when stored. "Pigs won't eat mud," they contend.

The dirt provides iron and other nutritional elements, but to make sure the early spring pigs get plenty of iron the Marsaus daub the sows' teats with copperas made sticky with syrup.

At farrowing time in spring Marsau and his son literally live in the hog house. They have a stove and ventilating system to maintain a temperature of about 70 degrees. When one of them sits up for mid-wife duties he brings out a rocking chair and a radio from the house.

As soon as the pigs are dropped they are dried in a box by the stove, and their "wolf teeth," or tusks, are snipped off immediately. Of course everything is kept scrupulously clean. Boar pigs are castrated when two weeks old, and all are vaccinated at ten weeks.

Spring pigs on the Marsau farm never get off concrete until they hit the chutes to be trucked to market. They are fed, watered, and get their minerals on a sheltered concrete floor. They soak up their sunshine on unsheltered concrete fixed with a manure trough at one side for easy daily cleaning.

Shoats are kept out of the manure trough by slatted panels, easily lifted out or aside, and which let the snow through. Water from hog house eaves is spouted through the cement into tiles.

A feature of the farrowing pens inside the house is that no guard rails are provided. The Marsaus don't have a great deal of faith in guard rails, but they b e l i e v e strongly in e l e c t r i c brooders. That's where the pigs stay when not nursing, "like a clutch of chicks under an old hen," and they don't get laid on, they say.

And that must be the truth, since the Marsaus didn't lose a single pig out of this year's spring crop, except the surplus 43 the sows couldn't nurse. It cost them $23 for electricity to operate the 15 brooders three or four weeks.

Iowa has hundreds of good hog men but none who top the Marsaus of Black Hawk County. The reason, in the words of E. L. Quaife, extension hog production man at Iowa State, is that "they do everything right."

Furthermore, as pointed out, they do it right from the first, and "the first" with the Marsaus is long before the pigs are farrowed.

New Developments in Britain's Agriculture

Dr. George Gretton

When Sir Stafford Cripps announced in mid-January that agriculture is to receive additional allocations of steel, he was spotlighting one of the most important aspects of Britain's reconstruction project. Behind the intense activity in the nation's workshops and foundries, there stands as a great stabilizing factor the highly developed agricultural industry. What is most interesting about it is the extent to which industry and agriculture interact and combine to play their parts in the complex social and economic development taking place in Britain today.

The days when farming and industry were two opposite and conflicting elements in the national life are long past—in Britain, at least. Agriculture is a technique as skillful as processing metals or making machines. The British farm worker is guaranteed a minimum wage which compares favorably in real terms with that of any other skilled worker, and his job is as much a technician's as that of anyone else.

This is not simply a matter of mechanization of farming, although this has been carried as far in Britain as anywhere else. It is also a question of the all-round development of the technique of food production. Characteristic is the fact that all types and sizes of British farms are mechanized. The application of mechanical equipment to the work of a large farm producing, for instance, thousands of acres of one or two similar crops, is a straightforward process. But more ingenuity is needed to introduce factory methods into a farm of fifty acres raising a variety of products.

Yet this has been done during the past few years in Britain on a vast scale. It has been made possible by a completely new approach to farming.

Recently there has been news of a nationwide scheme to enable grass drying to be done by small farmers on a cooperative basis. The Ministry of Agriculture is making loans and grants for the purpose of giving "practical assistance to schemes in the present development stage while they are becoming part of farming practice."

In other words, it is recognized that new techniques cannot be developed without experiment and organization, which are often not possible except in the case of a big undertaking with capital reserves. The British Government is

encouraging enterprise on the part of small farmers and guaranteeing that they will have resources for development and will not be out of their pocket.

The project was begun last summer under the auspices of the Milk Marketing Board, when forty farmers in an area of West England combined to provide three hundred acres of grassland. A cooperatively managed drying plant was employed to dry the grass thus produced. Three shifts per day, involving about 22½ hours out of 24, were worked in order to make the running of the plant as economic as possible, and it was possible to get two or three cuts of grass from each field in the season instead of one, while conserving the maximum food value.

Grass farming is a technique which has been very highly developed in Britain. Although the idea of treating grass or leys as a crop goes back to the nineteenth century, it was intensely developed shortly before and during the second world war by the British agricultural scientist, Sir George Stapleton. Ley farming consists of alternating grass and clover crops, of which special high yielding types have been evolved, with other arable crops. "Short Leys" are grown for from two to five years and either cut or grazed. When cattle are being raised on the same farm (and "mixed" farming is widely practised in England and Wales), the grazing and "treading" consolidates the young ley crop and fertilizes the ground for other crops.

Tests have shown that average output of dried grass from grassland of this kind is approximately 50 cwt. an acre, of which 820 lbs. is protein or body-building food. This compares very favorably with a yield of roots or kale. Tests have also shown that land re-seeded under ley has increased its stock-carrying capacity by three to five times. The "treading" and natural fertilizing by animals also improves yield from grain crops when they are subsequently sown in the course of the crop cycle.

This is the background of the recent announcement by the Ministry of Agriculture that a target is being set this year of a 20 percent increase in productivity of grassland. This does not mean a big additional acreage to be sown, but further development of the technique of grass farming. By more intensive fertilizing, using ever-improving strains of grass and clover, and by selecting alternative crops with the highest protein yield, it is planned to increase still further the food production from this important branch of farming. Britain's Government will see to it that cooperative schemes for the use of machinery-commanded loans and grants for capitalization will enable even

small-scale farmers to achieve high technical efficiency.

These developments in Britain are making a great contribution to the solution of the world economic crisis. They are also opening up long-term possibilities which will influence the efficiency of farming and the status of farmer in every country in the world.

Cow Feed

Condensed from Pennsylvania Farmer

A. A. Borland
Pennsylvania State College

IT TAKES a lot of cow feed to meet the requirements of the three million dairy cows in the nine North Atlantic states. Grassland farming is becoming increasingly popular in this section of the country, not only because of its advantages in conserving fertility and preventing soil erosion but also because it lessens the labor required to provide ample supplies of roughage for livestock.

Over 20 years ago J. W. White, research soil technologist at the Pennsylvania Experiment Station, pointed the way to greater returns of feed per acre in the publication of Bulletin 195 entitled Development and Value of Kentucky Bluegrass Pastures. Professor White stated that "fertilized Kentucky bluegrass pastures as compared with similarly fertilized four-year rotations of corn, oats, wheat and hay gave 10.9 percent greater weight of air dry matter, 7.4 percent more total digestible nutrients and 18.9 percent more digestible crude protein than did the grain rotation.

"The labor economy of pasture feeding is emphasized by the fact that to produce one ton of digestible crude protein in the grain rotation involves a labor cost of approximately $1.78, as compared with $2.82 for pasture. The labor cost for a ton of total digestible nutrients with corn silage was $21.21, while with pasture the cost was 66¢."

White concludes: "The above data serve to emphasize the economic importance of pasture feeding as compared with a system of grain rotation and seem to justify the use of land for highly productive pastures similar to that now used for cultivated crops."

In considering the value of dif-

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ferent forage crops it must be kept in mind that there are two general classes of roughages: first, those that contain liberal quantities of protein; and second, those that are largely carbonaceous in character. Clovers are an example of the first class and grasses and corn are examples of the second class. A judicious combination of these two classes of forage usually results in more economical feeding than the use of either one to the exclusion of the other.

Permanent bluegrass pastures are too often the only source of succulent feed. These are likely to serve the purpose pretty well in the early spring, but in late July and August they dry up and furnish insufficient pasturage to keep the cows in a good flow of milk. Our bluegrass pastures on the College dairy farm by top-dressing every other year with eight loads of manure per acre and 200 to 400 lbs. of superphosphate yield approximately six tons of grass silage per acre for half the area in May. The entire area is then available for pasture for the next two months but gets too short for good pasture by the latter part of July.

To overcome this late summer shortage of pasture, four six-acre fields were seeded to a combination of clover and grasses, including Ladino clover and orchard grass; brome grass and orchard grass; and Ladino clover, brome grass and orchard grass. Three of the fields were pastured in rotation each year, while the fourth one was being broken up and reseeded. Each pasture lot was fertilized yearly with 400 pounds of an 0–14–7 mixture. Such a luxuriant growth of pasturage resulted that it was possible each spring to cut one plot for clover-grass silage. The other two plots carried 3.2 cows per acre for two hours daily pasturage and after the second growth came on the three six-acre plots carried the 120 cows throughout the short pasture season, supplemented with some clover-grass silage. Thus, 18 acres provided the roughage for 120 cows for four months during the pasture season for two hours daily.

Dairymen generally find it advantageous to establish some Ladino clover-orchard grass plots that might be pastured in rotation. Research work at the Montrose Experimental Farm in Susquehanna county shows the advantage of introducing pasturage into a regular crop rotation. The five-year rotation and fertilizer procedures were as follows:

1st year—Corn—8 tons manure per acre; 250 lbs. of 20 percent superphosphate applied with corn planter.

2nd year—Oats—300 lbs. of 3–12–6 fertilizer in drill with clover-grass mixture.

3rd year—Hay—Two cuttings, no fertilizer.

4th year—Hay—One cutting

—second growth grazed—top-dressed with 320 lbs. of 20 percent superphosphate and 84 lbs. muriate of potash per acre the previous fall.

5th year—Grazed all season, no fertilizer.

The results of this crop rotation pasture system were compared with the yields from permanent bluegrass pastures. The yields from the crop rotated pastures were from 40 per cent to 136 per cent greater than from permanent pastures. Furthermore, the production of the crop rotation pastures after July 15 was more than double the production of the permanent pastures for this season of the year. In other words, the crop rotation pastures were producing liberal quantities of excellent pasture after July 15th while the permanent pastures lay dormant and unproductive. It will thus be evident that a good forage growing system will keep the cows filled up and will result in more milk and cheaper milk than would otherwise be possible.

A silo is an essential part of the dairy farm equipment because succulent feed is of much importance in the efficient and economical feeding of dairy cattle. The cooling, slightly laxative action of succulent feeds aids in keeping the digestive tract of high producing cows in good condition. Succulent feed also is usually very palatable and helps to keep the appetite sharpened so that larger quantities of feed are consumed.

Nine feeding trials at various Experiment Stations all showed increased milk returns per acre of corn harvested by the silo method rather than as dry fodder. The average for the nine trials resulted in 7.4 lbs. more milk from 100 lbs. of dry matter in the silage ration as compared with the dry corn fodder ration. Moreover there is a greater waste in harvesting corn by the dry method than by the silo method. At the Iowa Station an acre of dry corn fodder was estimated to be worth only 45 percent as much as an acre of corn silage for feeding dairy cows. The silo is also advantageous for harvesting surplus spring grass as grass silage and thus insuring a supplemental feed for the late summer and fall. Considerable experimental work has been done in recent years to determine what substances will serve as preservatives for grass and legume silages. Perhaps molasses is as satisfactory as any substance to increase the sugar content of clovers and grasses so that enough acid is formed by fermentations to preserve the silage. With alfalfa it is desirable to use from 40 to 60 lbs. of molasses per ton of green forage to insure the preservation of the silage. Finely ground corn and cob meal or other ground grains, at the rate of 150 to 200 lbs. per

ton of green leguminous material also makes a palatable nutritious silage. Legume silage is laxative. Therefore, it is advisable to feed dairy cows eight to ten pounds of sun-cured hay daily in addition to what legume silage the cows will clean up, so as to maintain them in good physical condition. The sun cured hay supplies vitamin D which is lacking in grass silage.

Roughage is low in cost of total digestible nutrients as compared with grain and hence pasture, silage and hay of good quality should be the basis of an economical and abundant supply of cow feed.

Maintenance Costs

Condensed from The Shorthorn World

P. T. Brown
Purdue University

THE farmer who keeps a herd of beef cows from which to raise his feeding cattle has two main problems. The first is to feed and manage the breeding herd in such a manner as to produce feeder calves for less than their market value. The second is to so feed and manage the calves that they may return him the most profit consistent with cheap gains and quick turnover.

The cost of producing calves varies considerably not only with price levels, but also with the manager's ability to hold down maintenance costs and to obtain a high percentage of calves.

It costs only about one-half as much a day to maintain a cow on pasture as in the dry lot. This comparison suggests that an important means of reducing the annual maintenance cost is the lengthening of the grazing period so that the cattle are kept on pasture as much as practicable and in the barns as little as possible.

Most farmers carry their breeding herds on permanent pastures through the summer. However, many who do not have enough permanent pasture are finding that a rotated pasture can be used quite satisfactorily as a partial or complete substitute. Timothy or a mixture of clover and timothy makes excellent pasture. Sweet clover has great carrying capacity and is being used more extensively

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in rotations and for pasture. Sudan grass is especially adapted for grazing during the hot dry months when bluegrass pastures are somewhat dormant. In many sections lespedeza is becoming important in pasture mixtures. Having too much grass is better than overgrazing the permanent pasture. The most desirable arrangement is to have available an abundance of rotated pasture which can be used for supplementing the permanent pasture or for hay.

Ways of lengthening the grazing period are pasturing stalk fields in late fall or early winter after grass is no longer available, supplementing the permanent pasture with rye or wheat for grazing during late fall and early spring, or saving one pasture for winter grazing. A pasture intended for winter grazing should not be grazed during the latter part of the preceding summer. Handled in this manner, the grass makes a rank growth which will fall down in a thick mat and be grazed easily by the cattle during the winter when the ground is not covered with snow. Some farmers thresh on their winter pasture so cattle can sleep around the straw stack. With good winter pasture and a plentiful supply of oat straw, dry cows can be maintained with little additional feed.

Other farmers supplement their winter pasture by scattering corn stover over the sod. If well scattered, the stover will be consumed with little waste, and the manure and stalks resulting from such feeding will cause a luxuriant growth of grass during the following summer. When such winter grazing and feeding are done on a rotated pasture which is to be plowed for corn the following spring, much labor and manure are saved and the corn crop is benefited.

The winter feeding period, although a relatively small part of the year, is usually the most expensive, and the best management should be exercised to hold down this cost.

The cheaper roughages should constitute the bulk, if not all of the winter ration for the cows, which leaves most of the grain and the higher class roughages for fattening market animals.

However, where large quantities of cheap unsalable roughage, such as straw or stover, are being fed, the owner should give the cows a small amount of either legume hay or silage.

Rations suitable for carrying dry cows through the winter are: 1. silage, legume hay, wheat straw. 2. silage, cottonseed meal, wheat straw. 3. legume hay with either oats straw, or corn stover. 4. silage with either oats straw, or corn stover.

In keeping with the idea of holding down the maintenance costs of the breeding herd, it is

well to urge the reduction of overhead charges, such as equipment, labor and bull service, to the minimum consistent with good herd management. For example, an open shed facing the south or east is quite as satisfactory for the protection of the dry cows as a costly warm bank barn with individual box stalls. A straw shed also makes a very suitable shelter because of its adaptability and cheapness.

Handling the herd as a unit rather than having it divided into small groups in different lots or buildings greatly reduces labor. Keeping the herd on pasture just as much as possible also cuts down labor, especially if there is a straw stack in the pasture.

Another item of overhead expense is bull service. For instance, farmers with small herds of less than ten cows have a much heavier charge against calf for bull service than farmers with herds of twenty or more cows.

Net maintenance costs can be reduced by conserving and utilizing fully the manure. The net value of the increase in crop yields due to the use of this manure, rightfully can be put on the credit side of the cowherd ledger; this opportunity for increasing profits should not be overlooked.

To produce his calves at a minimum cost, the owner not only must maintain his breeding herd cheaply but must produce as large a percentage of calves as possible.

The chief causes for low percentage of calves are contagious abortion and lack of attention at calving time. Contagious abortion is an infectious disease which may be indicated by premature birth, failure to clean soon after calving, and failure to get in calf promptly. Lack of attention at calving time may result in losses from chilling, smothering, accidental injury, and navel infection.

After the owner has worked out a satisfactory method of producing his calves at low cost, his next problem is how to feed and manage the calves. The best grades of fat cattle usually sell highest in the last half of the year while the common grades sell highest during the spring. If the cow herd produces calves of high quality, the owner probably will find it most profitable to plan his feeding operations so he can have his finished cattle on the fall market.

There are three systems of management used in Indiana that deserve consideration.

Selling yearlings in the spring is the most prevalent of these and consists in having the calves dropped during the spring months and allowing them to follow the cows on grass without grain until late fall when they are weaned. Then the calves are taught to eat grain, and after they are on full-feed, they are pushed rapidly for the next spring market.

This plan requires little labor

or attention during the busy summer months, but gives employment during winter and also permits selling the calves before spring work gets heavy. A disadvantage of this system is that the cattle go to market in the spring when high quality yearlings usually sell relatively low in comparison with medium to common cattle, and also in comparison with what they would bring on the late summer or fall market.

Selling long yearlings in the fall is really a variation of the first plan and consists of continuing the steers on full feed during the summer after the heifers have been sold on the spring market.

Selling baby beef by full-feeding winter and early spring calves through the nursing period and selling them on the late fall market is another method that is receiving increased attention. Farmers practicing this system of production aim to have their calves dropped during December, January, February or early March. As soon as they will nibble at feed, the calves are provided with all the grain and choice hay they will eat in addition to the cows' milk. When the cows go on pasture, the calves are continued on this grain ration, being kept either in the barn and allowed to nurse nights and mornings or in the pasture with a creep where they can eat grain.

This system of producing fat, lightweight calves at an early age enables Corn Belt producers to avoid the competition of the range breeders. Calves produced without grain up to weaning are classed properly as feeders and meet the direct competition of feeder calves produced on the western ranches. But finished calves that are nine to eleven months old, offered on the relatively high fall market, meet little competition from western feeder calves. Another advantage of feeding calves during the nursing period is the cheap gains made in this way.

Putting enough finish on calves to market them at the light weight and young age required under this system needs:

1. Well bred cows of beef type that produce liberal quantities of milk.

2. An extremely thick, early maturing bull. No one single thing will improve the quality of the market calves produced in the herd as effectively as the selection of a better bull each time a change is made.

3. Calves, born during the fall, winter, and early spring, December, January, February and early March, are suitable. Calves born later in the spring cannot be made fat enough for the late fall market.

4. A fattening grain ration (as much as the calves will eat) fed from the time calves will first eat until they are sold. They may be

fed grain in the barn or from a creep in the pasture.

5. Full-feeding in the dry-lot from weaning until marketed. Early born calves on a full-grain feed often will wean themselves by September or October. They should be continued on full-feed for another thirty to sixty days to give them as much additional weight and finish as possible.

Fattening calves at the Purdue Experiment Station show the following rations to be suitable:

1. Shelled corn (full-feed), protein supplement (2½ lbs. daily for each 1,000 lbs. of cattle), silage, clover hay.

2. Shelled corn (full-feed), protein supplement (2½ lbs. daily for each 1,000 lbs. of cattle), clover hay.

3. Shelled corn (two-thirds of full feed), oats, whole or ground (one-third of full-feed), protein supplement (2½ lbs. daily for each 1,000 lbs. of cattle), clover hay.

Linseed meal, cottonseed meal, soybean oil-meal, or combinations thereof are suitable protein supplements.

Ration 1 is the Purdue standard ration which has been fed for approximately thirty-four years as a basis of comparison for measuring the value of other experimental rations. The protein supplement is fed at the rate of 2½ pounds daily for each thousand pounds of cattle. The cattle are allowed all they will eat of the shelled corn, silage and clover hay.

Ration 2 is recommended where silage is not available. As good cattle can be made with this ration as when silage is included. However, silage usually reduces the cost of gain.

When oats are cheap and plentiful, they may be fed as outlined in Ration 3. Purdue experiments show that when one-third of the shelled corn is replaced by medium ground oats, the cattle gain as rapidly and more economically than when the grain consists of shelled corn alone. Either medium ground or coarse ground oats are more efficient than whole or fine ground oats.

Valuable Dust

Most valuable dust in the world is pollen. Without pollen there would be no plant or animal life.

—New Jersey Farm and Garden

Hay Yield Up 300 Percent

Condensed from Soil Conservation

Clarence S. Jones

DR. H. H. ZEIGEL of Collbran, Colorado, increased his hay yields by more than 300 percent within 4 years. In 1945 he put up 200 tons of good quality alfalfa-clover-grass hay from the same ranch that cut only 65 tons in 1942.

Collbran is a small town in the Plateau Valley about 45 miles east of Grand Junction, elevation 6,100 feet. It is surrounded by nearby mountain ranges on the north, south, and east.

Dr. Zeigel is director of the Plateau Valley Congregational Hospital at Collbran, and also is known as a mighty good farmer. When he is not busy at the hospital he can usually be found at one of his three ranches. The one he calls his Libby place is a 200-acre irrigated ranch 5 miles southeast of Collbran. It includes 145 acres of hay and small grain land and irrigated pasture. Dr. Zeigel bought this place in the spring of 1942, when about 80 acres of the flat bottom land were spotted with patches of foxtail, with cattails occupying the draws. Serious erosion was evident on the steeper slopes, the ditch system was poorly arranged, fertility was low, the improvements were poor and everything in general was in run-down condition. Only 65 tons of hay were put up this first year from two cuttings.

Dr. Ziegel, being a physician, analyzed the symptoms and prescribed a good heavy dose of soil conservation. But as there was no soil conservation district in Plateau Valley at that time he had to take his prescription to the conservation office in Grand Junction, 45 miles away. A few days later Service technicians and the county extension agent got together with Dr. Zeigel and looked the place over. A few test holes showed that the water table on about 80 acres of the bottom land ranged from 2 to 4 feet from the surface. This was reflected in a poor stand of alfalfa and an abundance of foxtail.

A soil and moisture conservation plan was prepared which outlined the conservation practices that Dr. Zeigel wanted to apply and the amount of technical assistance needed. With this assistance he began to reorganize his irrigation system, putting the ditches on

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a proper grade, shortening the length of runs and picking up waste water, wherever possible, to be used again. By the installation of a 6-inch wooden stave pipe, 860 feet in length, he was able to pick up excess water on the south side of Grove Creek and syphon it across to the pasture on the north side where it was badly needed. To obtain constant control of the head of water in the ditches and to eliminate lots of shoveling, he installed prefabricated concrete checks or turnouts at ditch intersections.

The wet bottom land was planted to a mixture of grasses and clovers best suited to high water-table conditions. A special mixture was used on areas showing signs of excessive alkali. The mixtures included meadow fescue, smooth brome, timothy, red top, reed canary, alsike clover, ladino clover, red clover, and strawberry clover. Proper attention was also given to fertilizing, grazing management, and gully control.

Dr. Zeigel thought the demonstration plan was fine for a starter. But he decided to install some drainage ditches and he needed a dragline to do it. Also, it was inconvenient for him to obtain technical assistance from the Grand Junction office 45 miles away. He was even thinking of jobs that he would like to do on his other ranches. As he was an old-timer he knew that the production of the entire Valley was only half of what it should be. He knew of several other ranches in a condition similar to his own. In talking with several of his friends and neighbors he found a few who were interested in a soil conservation district to include the entire drainage area of the Valley. In 1943, therefore, the Plateau Valley Soil Conservation District, including over 396,000 acres, was organized.

Soon after a technician was assigned to the district, a district plan was prepared. Under this plan soil scientists made a detailed study of the seepage on the Zeigel ranch to determine the feasibility of drainage. After completion of the drainage investigation, 4,200 linear feet of open drain ditch were cut, some with dragline and some by blasting; more irrigation ditches were built on proper grades, and more concrete checks were installed. The total ran to 2,725 feet of new field ditches and something over 18 concrete checks.

All available barnyard manure, plus 100 pounds of phosphate per acre, are now applied to the cropland each year. On hayland it is spread ahead of a springtooth harrow, but it is drilled in with fertilizer attachment at the time of seeding on grain land. This practice was first started in the fall of 1942.

Dr. Zeigel owned around 25 head of cattle and 300 sheep in

1942. Now he has over 100 head of cattle and 475 head of sheep. He shifts them from one ranch to another as feed and pasture conditions require. However, most of this number are run on public range during the summer.

No hay was sold from this ranch in 1942. From the 1945 crop 100 head of Dr. Zeigel's cattle were fed all winter and 100 tons were sold at $20 per ton for feeding.

Many people are afraid to try the conservation way of farming because they cannot afford the extra cost. The Zeigel figures throw some light on this. The wooden syphon cost $430, the drainage ditches $627.78, and the concrete checks $27. Phosphate for 145 acres cost about $435 per year, or $1,305 in 3 years. This makes a total cost of $2,389.78, with the phosphate cost being spread over a period of 3 years. The AAA payments Dr. Zeigel received amounted to about two-thirds the cost of phosphate and about one-third of the other expenditures. This leaves a total net cost to Dr. Zeigel of about $1,158. The yield of hay alone for 1945 was 135 tons more than was produced in 1942. This additional hay was worth $2,500, although only $2,000 worth of it was actually sold. The remainder was put into an additional 75 head of cattle above the number kept in 1942, with one stack being held over for reserve. Dr. Zeigel calls this his insurance. In comparing these figures it should be remembered that the total cost is considered for the 3-year period, while the increased production is figured for the 1 year, 1945. Actually there was an increase in production of grain in 1945 and of both grain and hay in 1943 and 1944.

Other conservation practices projected for this ranch include leveling, completion of the drainage system, weed control, construction of a fishpond, and further improvements of the irrigation system to better utilize the water from the drainage ditches for irrigation. Bromegrass will be planted with new seedings of alfalfa for erosion control and to maintain a high level of organic matter in the soil. Desirable irrigated pastures will be included in the regular rotation system.

A few management factors that Zeigel considers important in increasing production are as follows: (1) Sufficient labor and machinery to do the various jobs when they should be done, (2) moderate application of irrigation water, (3) prevention of waste-water loss, (4) elimination of injury to hay stands by avoiding close grazing in spring and fall, and (5) keeping good stands of hay at all times through new seedings, or drilling in a few pounds of red clover in old stands, with phosphate in the fertilizer attachment. Zeigel believes that it doesn't cost any more

to farm the right way than to farm the wrong way.

Improvements on this ranch have by no means been confined to the land alone. A new feedshed, with concrete foundation, was erected. The total cost of the structure was $1,600, which Zeigel estimates as probably $400 more than it would have cost to build during favorable weather conditions. However, he figures that the labor saved in feeding, better utilization of hay, and the protection afforded to the livestock will soon off-set this extra cost. It is an automatic affair, or self-feeder, that will accommodate around 200 head of cattle. The feed bin will hold from 100 to 125 tons of chopped hay; the funnel is shaped at the bottom to allow self-feeding into the bunks which extend all the way around three sides. These three sides are protected by sheds, the north side being closed and the others open.

Next to be contemplated was equipment for picking up hay from the windrow, chopping it in the field, and loading into trucks or wagons to be hauled to the shed and elevated into the bin, another prospective big saving in labor.

Low-Acid Peaches

Two new low-acid peaches have been developed at the Rutgers Experiment Station. Both of the new varieties, which can apparently be eaten without distress by persons suffering from high acidity, were originated by the late M. A. Blake.

Measured in terms of what is called "titratable acidity" the new varieties are below five, whereas a peach like Elberta tests from 9 to 12, or even higher.

One of the peaches—Honeygem—is a yellow variety, and the other—Newcheer—is white. Both are late, ripening after Elberta, both are freestone, and both are recommended for either canning or freezing in addition to eating fresh.

A limited number of trees is available for general distribution through the New Jersey Peach Council.—A. J. FARLEY.

—New Jersey Farm and Garden

Reducing the Cost of Production

Condensed from Guernsey Breeders' Journal

H. P. Ewalt
Oregon State College

MILK is one of the largest single sources of cash farm income, and represents an industry developed on standards of sanitation, pasteurization, economical distribution and health safeguards, that have made our system of supply and distribution a world standard.

In these days of high feed and labor costs, more attention must be directed to methods of lowering the cost of production in the dairy industry. A great deal is written and spoken about the price of dairy products to the consumer. When demands are made for an increase in price, thoughts immediately go to costs of production and margins of profit. No industry can survive very long with inefficient production methods, particularly when its products are sold on a highly competitive market.

While some difference exists between incomes of different dairy farms, because of the difference in market price received, the greatest difference in income is due to production costs on individual farms.

There are a few major factors affecting cost of production. The first and most important of these is the level of production per cow. Over 40 years ago, production testing through dairy herd improvement associations was started, and during that time the level of production has gradually increased in association herds. In the last 20 years production increased from 290 to 356 pounds of butter fat per cow, annually. In Oregon, the level of production in associations is about 370 pounds of butter fat per cow, which is about 100 pounds of butter fat more than is produced by the average Oregon dairy cow. There are also a good many herds maintaining annual averages of 500 pounds of butter fat, which is proof that higher levels of production can be reached.

It costs just as much to raise and maintain the low producer as it does the high producer. It is the amount of production over and above that required for maintenance that is important to profitable dairying. The following table illustrates clearly the importance

Reprinted by permission from the Guernsey Breeder's Journal, March, 1948, Peterborough, New Hampshire

Level of fat production (pounds)	Value of product (dollars)	Feed cost (dollars)	Income over feed cost (dollars)
200	176	98	78
300	253	114	144
400	338	130	208
500	411	142	269
600	493	159	334

of level of production as a factor in cost of production. This table was made from 1944 National D.H.I.A. reports from various states.

Factors other than level of production only enter into these figures, but the production level has the greatest influence.

Better Sires: Increasing milk and fat production at the lower levels of 250 and 300 pounds is not too difficult. When the production level reaches 500 pounds, the dairyman has a real problem in maintaining that level. The use of better sires is the first step. As long as many of the dairymen use ordinary or scrub bulls, yearly increase in production will continue to be slow, or will even slip back on the average herd. Far too many cows are being bred to scrub bulls, or cross bred to beef bulls. In dairy herd improvement associations more attention is given to the selection of the sire, and we see higher production than the average, with over half the sires showing an increase in the production of daughters over their dams. In artificial breeding associations, where the sires are selected with utmost care, 75 percent of the sires increased daughters over dams. This certainly indicates the value of careful selection of the sire as the first step toward increased production per cow.

Selected Dams: The next step is to save heifers out of dams selected for uniform high production and long useful life. One more calf, and one more lactation added to the lifetime record per cow, would in itself greatly lower the cost of production. More attention to the details of proper selection, feeding, and management, will increase the length of useful life of the average cow. Carefully selected well grown-out heifers will pay off in increased production and less danger of disease.

Cow Families: Replacement should come from cow families that have demonstrated long life, good production, desirable type, and good breeding efficiency. A study of herd records will show which families increase and supply surplus stock, which barely maintain themselves, and those that run out due to disease, low production or non-fertility.

Testing for Production: Again we turn to the records of herd improvement associations, and breed association test records, for proof

that testing pays. It is not uncommon in testing associations to find the ten high cows averaging 550 pounds of butter fat, and the ten low cows averaging 250 pounds of butter fat. Likewise, within a herd we find the same differences. The low producer may actually be eating up a considerable part of the profit of the higher producing cow. The herd average may be 400 pounds of fat on the basis of milk weights and tests from the milk plant, but these records do not locate the boarder cow. Too many cows are rated on a few months' heavy production, while it is the annual production that counts and pays the feed bill. Only testing of individual cows will give the needed records.

Culling: Rigid culling, on the basis of recorded performance, is one of the quick steps toward cutting production costs. In many instances the culling does not go far enough. One or two heifers may have been kept from a cow pending a record of her performance. When the dam does not measure up to the standard set, consideration should be given to culling the daughters along with the dam, depending on what may be expected in the inheritance from the sire. Bull calves should be selected with greater care. Too many are raised for use as herd sires that never have a chance of increasing production, a fact that may be determined by a study of their pedigree.

Improved Feeding Practices With Better Feeds

Research in the feeding of livestock has been going on for many years, and many practical aids have been developed. Efficient, economical feeding begins with a well-planned farming and pasture program. The development of new and improved forages have brought revolutionary changes which are yet to be followed by many dairymen.

More Pasture: Most of the pasture at one time was a native grass on the poorer soils that were unsuited to general farming. Pasture now holds first place as soil building, soil conserving, feed producing forage. Next to high individual production, pasture is equal, or a close second, in the step toward lowering the cost of production. A well developed dry land, or irrigated pasture, will provide the cheapest feed obtainable for dairy cattle. Pasture is cheap in many ways. It saves labor, produces more total digestible nutrients per acre, and in a most palatable form. Cows may get from 75 to 100 percent of their total feed requirements from pasture for six to seven months out of the year. Under average conditions, 100 pounds of total digestible nutrients in grain will cost twice as much as 100 pounds of total di-

gestible nutrients in hay. Pasture can produce the same feed value at one-half the cost in hay, and one-fourth the cost in grain.

Grass Silage: Next in value and low cost is properly made silage. A program of abundant pasture will mean an excess of early forage that can best be preserved as silage. Silage can be made in weather that will not permit hay making, and will conserve more feed value per acre of crop than will hay making under average conditions, and at less labor cost. Present labor saving equipment will encourage the use of this method of storing forage, and will aid greatly in reducing the cost per ton. Crops normally used for hay can in many instances, because of weather, be preserved as silage, and produce feed of higher value at less cost.

Higher Quality Feeds: Cost of production may be lowered by producing and feeding roughages that have the highest possible feed value and palatability. Palatability is important in reducing waste, and in getting cows to consume more of the cheap feed. That is one of the reasons pasture holds the position it does. Cows will graze to capacity, and there is little or no waste. Good silage follows next, for the same reason. How often we see hay cut when it is over-ripe, then allowed to cure too long, with a loss of leaves and feed value due to drying and leaching. Cows fed this kind of hay will not eat as much as they will of a high quality hay. As a result, more higher protein grain mix must be fed for maximum production.

Feed Grain According to Production: Grain is the most expensive feed and should be fed as a supplement to roughages. As such, it should be fed only after the cow has consumed the maximum amount of roughage. Then, grain should be fed on the basis of individual production, and only in such amounts as will enable her to produce all that inheritance makes possible. There is enough feed value in one pound of grain to enable the cow to produce about one tenth of a pound of butter fat. At this ratio, careful feeding of grain will be profitable. Feeding individually, according to production, usually results in less total grain being fed to the herd where grain feeding is liberal.

Save Protein: Costs of production may be lowered by more careful attention to the use of protein in the cow's ration. Protein is high in pasture forage. Harvesting forage at the right stage of growth, and preserving under proper conditions, will increase protein yield as much as 20 percent per acre. Preserving as silage may save as much as 10 percent more protein than storing as average hay. The percent protein in the grain mix should be limited to the minimum

needed, considering the quality of the roughage being fed. It costs less to grow protein than to buy it in a grain mix.

Steps to increase production and improve feed are a part of good herd management. However, the profit established by these steps may be completely lost in inefficient use of labor, an uneconomical size of unit, or herd practices which allow or encourage disease conditions. The keeping of adequate records of operation are essential to good herd management. Only records can show where losses occur, and where the profit leaks in operation are.

Disease control: Raising replacements is most desirable. When purchase is necessary, only disease-free animals from disease-free herds should be considered. Regular testing for Bang's and mastitis will help to reduce the disease loss which may wipe out all the profit from even the highest producing herd. Sanitary housing and milking practices can easily reduce by half the losses from mastitis alone.

Improved Breeding Efficiency: Long dry periods and early loss of cows from sterility is a hard one to check. High quality feeds, pasture and selection of replacements from long-lived individuals and cow families will help.

Labor Saving: The first step in labor saving is in harvesting equipment, such as field cutters for silage and hay, because these not only save labor, but may greatly improve the quality and value of the feed. The second step is to check the chore routine to eliminate wasted effort. Savings of 25 percent have been effected by rearrangement of barn layout. The use of feed carts, tub carriers replacing wheelbarrows, and rapid milking practices, all reduce labor. The size of the herd in comparison to facilities and labor available is an important factor in cost.

Rapid Milking: Training cows to milk out in three to four minutes, and stripping with the machine, have cut milking time as much as 20 percent, and relieved the use of one man at milking time from doing the stripping. Many herds have reported increased production from rapid milking practice. In addition, better udder health results from this more careful use of milking machines.

Dairy farming should be a long-time enterprise based on the sound practices herein discussed. It is a basic industry that will reward the business-like operator in proportion to his efficiency of operation, and give him the satisfaction of producing one of the most important and essential human foods.

Lespedeza Sericea and Crimson Clover

Condensed from Better Crops with Plant Food

L. O. Brackeen
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A COMBINATION of two popular soil-building crops which reseed themselves on the land each year may be the answer to Southern livestock farmers' dreams for year-around grazing on the same land year after year. This same combination is also being used in producing two seed crops and a hay crop on the same land each year.

The two crops are lespedeza sericea and reseeding crimson clover. Lespedeza sericea is a spring and summer crop, while crimson clover is a winter crop.

Already several north Alabama farmers are using the combination with excellent results. For instance, E. L. Hood of Albertville is grazing dairy cows on a 4-acre field about 11 months in the year. Boyd Vineyard of Albertville and Tom Williamson of Athens harvest crimson clover seed and a combination of sericea and crimson clover hay each spring, a crop of sericea hay later in the year, and a crop of sericea seed in the late summer or early fall, all from the same land.

All of these farmers got their ideas from Fred Stewart, Superintendent of the Tennessee Valley Substation, Belle Mina, Alabama, when visiting the station with their county agents. While Mr. Stewart's experiments are only two years old and the results are not conclusive, he is convinced that the crimson clover-sericea combination gives promise of producing far greater volume and length of grazing than the best permanent pastures in the Tennessee Valley. "The two legumes grown in combination have provided almost an unbelievable amount of grazing," he says.

During the two years that Mr. Stewart has observed the two crops growing on the same land, an area of 1.7 acres has provided constant grazing with the exception of 39 days in a 730-day period. From October 1, 1945, to September 27, 1946, the two crops were pastured 322 days. For 151 days the grazing rate was two animals on the area; for 71 days, six head; and for 101 days, five head. The animals were withheld from

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the forage for 21 days in May and 18 days in September to allow the crops to mature seed.

In the next period, the combination was pastured continuously for 369 days by two animals, for 61 days by six animals, for another 61 days by eight animals, and for 92 days by 10 animals.

For the first year and a half no weights were taken. However,—six Hereford bred heifers grazing the 1.7 acre area from May 1 to October 1 the past year gained 710 pounds or 417 pounds per acre.

For the past several years both lespedeza sericea and crimson clover have gained in popularity in Alabama and other Southeastern States. This has been due to experiment station results and actual farm experiences showing that both crops are good not only for grazing but also for hay and seed production and soil building.

Popularity of crimson clover has jumped by leaps and bounds since Southern experiment stations and the research center at Beltsville, Maryland, developed and tested reseeding varieties. So popular has become reseeding crimson clover that agricultural workers have had to advise farmers to beware of seed racketeers who are selling many regular seed as of reseeding variety.

Crimson clover is a winter-growing crop that is usually planted between July 15 and October 5. If grown for soil improvement, it is best to fertilize it with 200 to 300 pounds of superphosphate or 400 to 500 pounds of basic slag and 50 to 75 pounds of muriate of potash per acre. When grown for grazing it needs heavier applications of fertilizer. A light application of manure is helpful in establishing the clover.

For several years farmers have found that they can successfully grow lespedeza sericea on their land and are now observing that it gives good grazing if grazed while the plants are young.

Experiments at the Alabama Agricultural Experiment Station, Auburn, have shown that both beef and dairy cattle do well on a cropping system including lespedeza sericea, kudzu, oats, manganese bur clover, and grain sorghum. In the experiments, the cattle are grazed on sericea much of the time from April 15 to November 15.

"We have found it most important to allow sericea to become well established before it is grazed," reports J. C. Grimes, Animal Husbandman at the Station. "For this reason, grazing is not recommended until the second year. But, when grazing is started, it is important to start cattle on the sericea early in the spring when the young shoots are 3 to 4 inches high. One cow per acre appears to be about the best rate of good stocking at Auburn; how-

ever, at this rate it is sometimes necessary to mow the sericea to keep the plants from becoming too coarse and woody."

W. W. Cotney, Superintendent of Upper Coastal Plains Substation, Winfield, Alabama, has definite proof the sericea can be used in growing seed for cash. On 14 acres of eroded slopes seeded to sericea in the spring of 1946, the sericea produced 300 pounds of seed per acre in the fall of 1947. Value of the seed in the hull was estimated at 15¢ per pound or $45 per acre.

Lespedeza sericea usually is planted in the lower section of the Southeast in late February and in the northern part of the area from March 1 to April 15 as soon as danger of freezes has passed.

Those succeeding best with the crop broadcast either 400 to 600 pounds of superphosphate or 600 to 1,000 pounds of basic slag per acre. They also apply from 100 to 200 pounds of muriate of potash per acre, and repeat the fertilizer application every year just before growth starts in spring.

These facts about each crop have been given to show that when farmers grow the crops together they are using a combination of two good legume crops.

Piaseczno—A Model Village

Condensed from Poland of Today

TOWARD the end of 1944 the war communiques from Europe's eastern front repeatedly mentioned the name of the little Polish town of Warka. This settlement on the banks of the Vistula owed its renown at the time to the nearby Soviet bridgehead which was the center of particularly fierce fighting. As a result the villages surrounding Warka were reduced to ashes. They were actually razed to the ground, not a single house remaining. Today these villages are being rebuilt, and the reconstruction of one of them—Piaseczno—is to set the pattern for the reconstruction of other Polish villages and farms.

The whole world honors the memory of Lidice, the Czechoslovak village which the Germans burned down and whose population they murdered. But Poland had hundreds of such Lidices. The fate of Lidice was meted out to Polish villages for sabotage, for helping the partisans, or for fail-

Reprinted by permission from Poland of Today, New York, N. Y.

ing to meet the quota of foodstuffs. In such cases the Germans would surround a village, set the houses on fire and kill the defenseless inhabitants. This explains the many scenes of wreckage which indicate that once there had been human settlements in their places.

But the greatest disaster was to come in the last year of the war. Poland became one vast battlefield, and the retreating Germans marked the route of their defeat with the ruins of towns and villages. Worst hit of all were areas along the large rivers—the Vistula and the Oder. Warka and Piaseczno were located in such an area. Destruction of farm buildings in these territories averaged 60 percent, in many cases it was considerably higher.

The reconstruction of villages was one of the main tasks confronting Poland after the liberation. The Three Year Plan provides for the rebuilding of 550,000 farms within the 1947–1949 period, with direct government aid to be extended to 337,000 farms. Credits for this purpose are to total 23 billion zlotys.

The first and immediate task was to repair those farms that were only partly destroyed and possessed habitable dwellings. But very soon came the turn for those totally in ruins, which required construction of new homes. The government grants not only financial loans but also supplies building materials and tools.

The following problem arose from the very beginning: Were the rebuilt farms to be a replica of those before the war? Was the Polish peasant to live in the same way he lived before the war, was his farming equipment to be the same?

The answer was—an emphatic no! The new Polish village must be superior to what it was before. The destruction of the war must be made to serve at least one good purpose—that of creating a more progressive village with better housing and health conditions and improved communication facilities.

The Ministry of Reconstruction agreed that an experiment had to be made. A village was chosen worse hit than the average. Piaseczno was to set the pattern for other Polish villages and its reconstruction was to provide the necessary experience for the rest of the country.

Preliminary studies centered around three basic problems: (1) Over-all plans for the settlement as a whole; (2) Plans for the individual farm; (3) Best possible utilization of existing building materials. The results were carefully examined and revised as reconstruction work proceeded.

Piaseczno has been rebuilt. In a picturesque spot on the banks of the Vistula its widely scattered

buildings cover an extensive area, with each individual farm being built according to a carefully laid plan, keeping pace with up-to-date requirements of technical science. Each home is planned for a family of five to seven. The houses have five or six rooms each, and they are equipped with running water and plumbing for future bathroom fixtures.

The farm buildings are spacious, light and well aired. Barns and stables meet the standards of modern hygiene.

Most of the buildings are of brick and the inner walls of the dwellings have a concrete lining to provide protection against humidity and the cold. Unlike the pre-war village, the new Piaseczno makes only scant use of timber.

The village has a sewage system and electric lighting, luxuries unknown heretofore. The center of the little town has not yet been completed. Here will be the church, the community center with its assembly hall, library and auditorium, as well as the cooperative stores, the bathhouse and the health center. Another building nearby, still under construction, will house the bakery, the fire station and the public garage.

Piaseczno will continue to grow and develop. The plans provide ample scope for future improvements and progress. That which has been accomplished up till now represents only a minimum program, to meet the requirements of modern living. But compared with conditions prevailing in pre-war Poland, this minimum means indeed a fantastic stride forward.

Improve Egg Quality by Breeding

Condensed from American Poultry Journal

Joseph P. Quinn
U. S. Department of Agriculture

SELECT and breed to improve egg quality because several market egg characteristics are known to be heritable. Daughters of hens that lay large eggs usually lay eggs of good size. Daughters of hens that lay good shelled eggs generally lay eggs with good shells. Improvement in egg shape, egg weight, shell quality, shell color, amount of thick white, and keeping quality of thick white will definitely enhance market egg quality. Each of these mar-

Reprinted by permission from American Poultry Journal, January, 1948, Chicago, Illinois

ket egg characteristics has proved to be an inherited trait. On the other hand certain exterior and interior defects, also inherited, may affect quality adversely.

So we should select and breed for desirable egg qualities and select against defects. A recent survey of city egg consumers showed that 80% of them wanted "the best" eggs. They were quite specific. They wanted eggs that were "large, Grade A, well-packaged" and "fresh." This means top-quality, and breeding for and producing top-quality will help keep egg consumption at its present high level.

A fairly round egg, tapering gradually from large to small end, is the most satisfactory egg shape. Long, pointed eggs may get broken in shipping. Round, fat eggs won't fit standard fillers. Eggs of abnormal shape often have shells of poor texture.

Egg shape can be easily changed by a few years of careful selection directed toward the desired goal. There will always be some minor variations because no two eggs laid by the same hen are molded in exactly the same way. But shape can be definitely changed as shown by breeding investigations. At Pennsylvania State College, two lines differing distinctly in egg shape were developed: a round egg line, and a long egg line. The lines were easily established, and the uniformity of the progeny suggested that a limited number of genes were involved.

Egg size pays off because higher prices are obtained for Grade A eggs than for Grade B or Grade C eggs. Remember that daughters of small-egg hens will lay small eggs, and daughters of large-egg hens will lay large eggs. Eggs 20 ozs. or less to the dozen and eggs 27 ozs. or more to the dozen in weight, do not hatch so well as medium sized eggs, as a rule. And there is no profit in getting eggs too large to be packed in the ordinary container.

Breeders have done a good job in breeding for egg size, but there are many good producing flocks in which small egg size is a chronic eye sore. In such cases, breed for increased egg weight as did the Beltsville egg breeders. Over a 5-year period, they raised average egg weight from 23.2 ozs. to 25.4 ozs. per dozen. And they advanced the date when the pullet eggs reached standard weight from May to December.

When the flock produces strong shelled eggs, producers can market the entire egg crop. So why not improve shell quality permanently by breeding from hens that lay strong shelled eggs in summer as well as in winter? Many hens lay good shelled eggs in the winter months but porous, rough, thin shelled eggs in the summer and fall. Don't breed such hens! Breed only hens that lay eggs with good,

heavy shells in summer as well as in winter. August, September and October are good months to select these breeders.

Egg breeders at the Agricultural Research Center, Beltsville, Md., have developed two lines of birds that differ widely in shell quality. In the poor shell line, about 3 1/3 times as many eggs were cracked and broken in routine handling as in the good shell line. The two lines have been developed by selection based on loss in egg weight, an excellent measure of egg quality and a heritable characteristic. Use the egg-weight loss method to select breeders.

Shell color is also inherited. Crosses between white egg and brown egg varieties lay light brown, tinted, or cream colored eggs. Shell color may be associated with shell thickness. Shell color is important in some markets; in others, not.

Eggs with a high percent of thick white stand up well when broken out. Eggs with a low percent of thick white appear excessively watery. A high thick egg white is more satisfactory for poaching because a large amount of thick white supports and covers the yolk. Because excessive heat exposure liquefies the thick white, many suppose that a watery egg has deteriorated. This is not necessarily true, as the watery egg may be a result of heredity. What the consumer likes is a high thick white which gives the egg an upstanding appearance. He knows that such an egg is a fresh egg.

The high thick white line at Beltsville averaged 65% thick white; the low line 40%. Reciprocal crosses of these two lines averaged 54%, the amount found in the average egg.

Consumers prefer eggs with a high percentage of thick white for psychological and culinary reasons. But they also want keeping quality.

A good shell helps to maintain keeping quality by reducing weight loss as we have seen. And within the egg, a durable, non-deteriorating thick white will continue to surround and support the yolk as long as the white holds together. In short, eggs keep better when the thick white is resistant to heat and other deteriorating influences.

Beltsville egg breeders have developed a heat-resistant type of thick white in a flock of White Leghorns by 7 years of breeding. This type of thick white holds together very well for about 14 days at 100°F. and is a great improvement over the ordinary thick white, which retains its initial quality for only a very short period.

Blood spots in eggs are quite common. Surveys of farm flocks have shown that incidence of blood spots ranges from 15 to 50%. As a rule, the eggs laid by White Leghorns have fewer blood spots than the eggs of the heavy varie-

ties. At the Western New York Egg Contest, blood spots ranged from 15% in White Leghorns to 58% in New Hampshires. But since the percentage of blood spots depends on hereditary factors, any variety may produce eggs with a high or low percentage of blood spots.

At Beltsville, the incidence of blood spots ranged from 61% in R. I. Reds to 4% in White Leghorns. Light Sussex and White Wyandotte eggs averaged about 32% blood spots. Crosses of White Leghorns and White Wyandottes were intermediate, their eggs averaging about 18% blood spots. Two lines of R. I. Reds have been bred at Beltsville, one line producing eggs which average 80% of blood spots, the other 20%. The development of the 2 lines shows clearly that blood spots are due to heredity, and that the incidence of blood spots may be greatly reduced by breeding.

Combine all heritable egg quality characteristics in a 200-egg hen. This means egg shape, egg weight, shell quality, shell color, a large amount of thick white, a heat-resistant thick white, and freedom from exterior and interior defects.

The surface has only been scratched in breeding for market egg characteristics. Take shell quality, for example. Shell strength is inherited, but what about shell finish? Is the glossy white shell better than the dull, chalky one? Is shell color associated with thickness of shell? In the good shell White Leghorn line at Beltsville, many of the strongest egg shells carried a heavy yellow tint. Is shell color associated with thick shell in dark brown eggs, so that the lighter colored browns have thinner shells? Reports from Massachusetts and Ohio say that dark brown eggs hatch better than lighter shades. Do the latter have thinner shells and greater weight losses in incubation?

Lupines For Grazing

Lupines, as cover crops and soil builders, have caught on fast in the southeastern states, although they have had little grazing value. Livestock don't like the bitter blue lupines, and there's danger of poisoning from the alkaloid ones.

Now comes news of some sweet yellow strains that are also *good for feed.* USDA crops men expect to have one or two of these new lupines ready for distribution before long.

—Farm Journal

Grass Insurance

Condensed from The Cattleman

Glenn H. Mueller
Range Conservationist, Soil Conservation Service

LEAVING a portion of the grass on the pasture each year is a paying proposition!

Misses Faye and Myrtle Harrell, ranch operators in the Upper Colorado Soil Conservation District near Snyder, Texas, know that for certain. Here is their story:

In 1934 they acquired a seven-section ranch that sheep had grazed heavily two years previously. For years before that, the place had been leased out. The Harrells put 80 head of stock on the seven sections and maintained that number for four years. Then they increased the rate of stocking to one hundred head. Three years later, in 1941, the stocking was increased to 20 head per section, 140 head altogether. That's the present stocking rate.

In seven years, through proper use of native grasses, the Harrells have been able to practically double their stocking rate. Today the better grasses—blue grama, sideoats grama and buffalograss are vigorous, producing large seed crops and spreading into the bunches of undesirable needlegrass.

The Harrells' experience shows that leaving a portion of the grass on the land each year is necessary. Here's why this is true.

Experience reveals that, with most of the better range grasses, 40 to 50 percent of a year's growth may be used continuously to raise livestock. During the non-growing season, or if the range is grazed down only once during the year, even more of the total weight may be used. Weight, though, as a measure of grass use can be confusing.

More than 50 percent of the bulk of a grass lies in the half of the plant next to the ground. A cow has to eat around 85 to 90 percent of a blue grama plant's total height before she has consumed 50 per cent of that plant's total weight.

What's the reason for leaving 50 to 60 percent of the weight of the present year's total growth standing in the pasture? It needs to be left because the remaining grass belongs to the plants and soil—it needs to be left as grass insurance.

Grasses manufacture most of

Reprinted by permission from The Cattleman, January, 1948, Fort Worth, Texas

their food in their leaves by using energy from sunlight to combine raw materials from the air and soil. If grazing stock eat all of a plant's leaves, the plant has no way left to produce food. No food, no seeds! No new shoots, soon no grass! The plant starves, just as surely as stock starve without food.

Grasses must store up food reserves if they are to develop properly, get through winters and survive drouths. These food reserves can be available only when a plant is allowed to keep enough of the food-manufacturing leaves. The alternative, as we have seen, is no food reserve, and that means weakened plants unable to endure hardships. The Harrells found this true during the extremely hot, dry summer of 1946. At that time many of the better quality plants on ranges where no food reserve insurance was on hand died in this area. The loss to the vigorous plants which the Harrells maintain in their pastures was comparatively light.

Grass insurance helps a plant develop a widespread healthy root system. There is a definite tie-up between the extent of the roots and the amount of growth a plant shows above ground. The root system gets shorter—less wide-spread—as the amount of leaves remaining on the plant declines past the food reserve safety point. Grazing, of course, is the usual way for leaves to get shorter. On a western range, where water is all important a plant must have a well developed root system to draw enough moisture and minerals to live—and to produce feed.

Grass insurance provides erosion control. Again we view the Harrell ranch for illustration. There a heavy sod of buffalo and sideoats grama grasses has sealed over old stock trails, roads, and small gullies. Litter of previous year's plant growth abounds. Leaving about 50 percent of the total plant weight growth each year offers protection to the soil in several ways. Fast falling raindrops, agents of erosion, are broken up; their speed and impact is reduced. The grass' broad network of root systems binds soil particles in place. The plants help more water soak into the soil. And since the wind can't tear directly at the soil because of the sod, wind erosion chances are reduced.

Grass insurance allows the greatest possible use of available moisture. The more water a range absorbs, and the less that is lost through evaporation and run-off, the more becomes available for grass production.

The more grass left on the pasture, the more plant litter. Litter forms little dams, holding back drops of water until they can soak into the ground. Litter also works as a sponge, absorbing water. Where snow is an important source

of moisture, grass left on pastures catches and holds it.

Grass insurance lowers evaporation in several ways. The plants reduce wind velocity at ground surface. Together with the shading effects of plants and litter, that helps slow down the drying out of the soil. In the dense sod of Robert King's pastures, the ground remains moist at the surface for several days after a rain.

Soil temperatures are cooler in summer and warmer in winter under a good cover of grass and litter. The grass and litter insulate the soil. In addition to reducing evaporation, this gives grass seedlings a favorable place to germinate and grow. An abundance of young seedlings of the better grasses shows up in the King pasture. Such new plants are needed to keep pastures producing forage continuously.

Leaving around half the weight of each year's growth of better grasses helps maintain soil fertility. Litter decays slowly and virtually is built into soil. Healthy root systems leave supplies of old roots available for the soil itself to use in growing future grass.

Failure to leave grass insurance lowers beef production in the first place, and costs the ranchman much future production. One cause of this, as we have already discussed, is that better forage grasses become less vigorous when stock eat plant foliage beyond the danger point. For example: Many pastures in the Upper Colorado Soil Conservation District practically made no growth during the drouth of 1946. At that identical time, in contrast, the Harrell and King pastures were doing moderately well. When quality plants weaken and die inferior plants begin to predominate. Needlegrass, hairy triodia, tobosa, red grama and several other inferior plants are in the majority in many pastures in the district. On those ranges the available livestock feed doesn't even compare with the production from quality grasslands. As the better grazing plants lose out on a range the soil is left with little or no protection. Bare areas develop. Litter is sparse. The soil crusts and cracks under pounding rains and trampling. The winds sweep unhindered at soil surface. Soil temperatures jump from extreme to extreme. Rainfall runs off instead of soaking where it can be used. In the same rain where the Harrell range had no runoff, water rushed off many pastures as if they were surfaced with concrete. Plant food and soil go with the water. Fertility declines.

Adjusting livestock numbers to the average amount of feed produced on a pasture will halt declining plant quality and quantity on a range. The way for an operator to find out how much beef

he can raise in an average year is to determine the amount of good grass his range will raise year in and year out.

The season of the year when the various grasses are at their best for beef production should be considered.

The amount of forage a native pasture produces each year varies widely. Accurate stocking records kept over a period of years, together with a thorough knowledge of the reaction of the better grass plants to grazing, will aid in reaching a satisfactory stocking rate.

Where available, temporary pastures of small grain, sudan, crested wheatgrass and weeping lovegrass, can be figured into the inventory. These pastures can furnish green feed at all times when native pastures are not producing. Any hay, bundles or concentrates fed also should be figured. Here again, accurate records are valuable.

Grass insurance, after all, is merely a working reserve that no sound operator can afford to be without. Nature gives grass. It requires sensible use, working with nature, for a stockman to keep it.

Calves Make Better Use of Grain

If you're full-feeding beef cattle, younger animals will produce the most beef per hundred pounds of feed.

Here's what a summary of 17 feeding trials made by several State Experiment Stations shows:

Calves, averaging 414 pounds when started on feed, gained 431 pounds in 197 days, or 2.19 pounds per day. They ate 1990 pounds of grain and 217 pounds supplement.

Yearlings, averaging 638 pounds at the start, gained 393 pounds in 174 days, or 2.26 pounds per day. They needed 2279 pounds grain, 188 protein.

Two-year olds, averaging 840 pounds when put on feed, gained 389 pounds in 162 days, or 2.41 pounds per day. But they ate 2552 pounds of grain and 170 pounds supplement.

To save you figuring, this meant that the calves ate 509 pounds of concentrates (grain and supplement) to produce 100 pounds gain, the yearlings 631, and the two-year-olds 709.

The older cattle naturally ate more hay and silage than did the calves.

—Farm Journal

Whey for Grass Silage

Condensed from Holstein-Friesian World

R. A. Page
Vice-President, Kraft Foods Company

IN THE past few years almost every farm journal in the country has published articles on the value of good grass. Like most dairymen, I've accepted this new gospel of grass and I believe that in grass silage we have found a most-efficient method of reaping the full benefits of good grass . . . a method of reaping the benefits not only in June and July, but during the dry pasture seasons of the late Summer and during the Winter months.

Last August, on a trip through the East, I couldn't help thinking what grass silage would have done to relieve the frustration of thousands of farmers in the rainy weather last summer, and of what it would have meant in terms of more-efficient and profitable milk production this winter.

At Unadilla Farm last year we filled a 12 × 50-foot silo from twelve acres of alfalfa and Brome grass, using dried whey at about 35 pounds to the ton as the preservative. We obtained excellent silage. The cows love it and we have no trouble in feeding it. We used a forage harvester to handle the grass. A forage harvester, chopping the grass in the field, is much the best for harvesting grass for silage. Green hay can be put through a regular silo filler, but it is more difficult and calls for heavy handling.

But a summary of the experiences of a number of our Midwest dairymen who turned to grass silage last year, when the prospects for the corn crop looked so black, is far more conclusive than the case history from a single farm. Their experiences indicate that grass silage, which provides positive insurance against late summer pasture shortages, or failure of the silo corn crop, offers so many advantages to dairy farmers that it promises to revolutionize crop methods on many farms.

Some of these farmers put up grass silage simply as insurance against dry pastures and a slump in milk production late in the summer. Others put part of their hay crop in the silo when they feared they wouldn't have a corn crop to provide succulent feed. In this experience they saw how easily grass or hay can be saved in the silo,

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and saw, too, how milk production figures were maintained and increased as the silage was fed out. As a result they're now considering grass silage, not just as insurance against failures, but as a basic part of their farm programs.

Here are some of the advantages offered by grass silage, as I look at it:

1. It preserves more of the feed value, particularly protein and carotene, in the grass crop;
2. This means less grain required for equal milk production or reduced costs for winter milk production;
3. There need be no loss of the crop through rainy weather at haying time;
4. The crop may be saved in a more orderly manner and labor distributed more evenly;
5. Use of the first cutting of the grass crop for silage permits a second crop off the same field for additional silage, hay or pasture;
6. A grass silage program helps in the control of weeds in that it destroys the viability of weed seeds;
7. A grass silage program makes control of erosion and insects easier;
8. It provides insurance against summer droughts, late planting seasons, extremely early frosts;
9. It can be used to preserve the feeding value of weedy crops;
10. It can be used to give pastures a much-needed resting period in the fall;
11. It makes for fuller use of silo and silo-filling machinery;
12. Grass silage makes for more vitamins and more color in winter milk and butter than either corn silage or sun-cured hay.

The first and most important advantage of grass silage is, of course, the fact that it preserves the high feed value of the grass crop. This helps a dairyman reduce the cost of winter milk production and permits him to obtain a much higher tonnage from the same field than he would obtain with dried hay.

I think we all agree that no feed can compare with rich June grass in boosting and maintaining milk production. And when grass or hay is cut into the silo within two or three hours of mowing, there's a minimum of loss of feed value, particularly of the protein and carotene content. There's less waste of the coarser stems of the first cutting of alfalfa and no shattering of leaves.

Any grass or legume hay crop, or any combination of grasses may be used for grass silage and the crop is normally left to wilt only from one to three hours. Because these grass and legume crops are

high in protein content, and, unlike corn or sorghum, are low in sugar content, they usually require a preservative to speed up fermentation action. The object is to get fermentation action started quickly and thus avoid spoilage.

Preservatives commonly used include dried whey, phosphoric acid, molasses, corn, and ground corn and cob meal. All have been used with reasonable success and effectiveness, but some are more easily handled and more economical than others.

Dried whey was used in the series of silo demonstrations in Wisconsin last summer under the sponsorship of the Farm Service Department of Kraft Foods Co. It proved effective in starting quick fermentation action and the silage kept well. This is due to the fact that dried cheese whey is approximately 70 percent lactose, or milk sugar, which is readily converted into lactic acid.

We found dramatic evidence of the effectiveness of dried whey in one silo where a couple of spots of spoiled silage were found. In these spots the silage was black and rotten. Samples were submitted to our research department for chemical analysis. Results showed a complete lack of whey powder, or of the lactic acid it creates, in the spoiled samples. The spots were small and insignificant in themselves, but they provided an excellent opportunity to see what the silage would have been like without the preservative.

The dried whey is added at the rate of 30 to 35 pounds per ton for most grass and legume combinations, being increased slightly where moisture content is high. This amount of whey powder has the preservative action comparable to 200 pounds of corn and cob meal, and at current prices is less expensive. Soybean silage requires almost double that amount. Dried whey offers special advantages because of its ease of handling. In its dry powder form it can easily be fed into the cutting box or blower by hand or hopper, or distributed in the silo as the grass is blown in. Less dried whey is required to the ton than most other preservatives.

Checks were made on all farms participating in the series of silo demonstrations. In every case they reported that the silage kept well, made succulent feed which cattle ate with apparent relish, and increased milk production for the herd. One of the most interesting reports was that of Ken Goeman of Antigo, Wis., who explained that his herd dropped in production when he started feeding corn silage after filling it in on top of grass silage he had previously been feeding. He, like many others who participated in the trials, plans to switch to grass silage in an effort to get more of the benefits of summer grass in the winter time.

In my own herd at Unadilla it has been very interesting to observe the relish with which the cows ate the grass silage and its comparison with the very finest quality of corn silage.

We feed our silage and grain at about 10:30 in the forenoon, and if any of the daily feeding of grass is not cleaned up before the cows are given their hay, they nose down through the hay to clean up every last slick of grass silage. On January 1, we opened our corn silage and started feeding it. Ten days later the cows were not quite reconciled to the change and when the switch was made we had a drop of better than half a can of milk. When the tester was at the farm on December 4th, we were feeding the grass silage, and were milking 17 cows in all stages of lactation and had 710.6 pounds of milk and 28.01 pounds of fat. When the tester came back, January 7th, we were feeding corn silage, were milking 21 cows, six of them fresh, and had 809.8 pounds of milk and 30.48 pounds of fat. We have been feeding a 13 percent protein grain ration and not very heavy because of the high cost. As far as we are concerned, grass silage, with whey powder as the preservative, makes a wonderful forage feed, maintaining production and body weight.

Push Button Pork Factory

Condensed from The Farmer

William H. Kircher

HAYES BULFER has a push-button pork factory in Blue Earth County, Minnesota. In it he puts two pounds a day gain on each of 225 head of hogs. Working alone he does the daily chores of feeding and watering in 30 minutes, 15 minutes in the morning and 15 in the afternoon.

Bulfer has discarded his scoop shovel in favor of downspouts and electrically powered conveyors. Faucets have replaced water buckets.

Basic feature of this labor and time-saving pork factory of Bulfer's is a building which combines a corncrib, granary and hog house.

The corncrib-granary building

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is arch roofed with center driveway. Cribs on either side of the drive hold a total of 4,000 bushels of corn. Six grain bins overhead, four of 700-bushel capacity, and two of 350-bushel capacity, take a total of 3,500 bushels of grain. The smaller bins are for mixed feed and seed, the larger for feed grain. In addition there is a small bin for concentrate which has a chute leading to the hammermill.

Joining the corncrib-granary is the hog house, 24 feet wide and 48 feet long. It was 18 below zero the day we were there, but with each hog doing his share as a furnace the temperature in the hog house was about 50 degrees.

What makes choring easy in this hog house is the size and type of feeders and the water system. The two self-feeders for the 225 head of hogs are 12 feet long, 4 feet wide and 4 feet high. They will hold a little more than 150 bushels of feed, but they are never filled because there is a tendency for feed to pack in them if they are filled to anywhere near capacity. Anyway, the job of putting in feed requires little effort. All Bulfer needs to do is pull a spout over, open it, and the feed comes rolling out. To get feed in the hopper-bottom bin from which it is fed into the feeders is not a scoop shovel job either. An elevator and spout does that job.

The 30 sows also get their feed from a self-feeder, one of about 1½-ton capacity. It can be filled with 10 to 12 days feed supply, and unlike the other big self-feeders it is so constructed that feed does not pack even when it is full. There is an agitator in this one, a bar to which blades are attached, and the sows themselves keep the feed agitated. To each end of the bar is attached an old cultivator wheel set far enough out from the feeder so the sows can use it handily for scratching their backs. They do enough scratching to keep feed pushed down into the feed troughs in large enough quantities to keep the sows supplied.

All this labor-saving equipment that Mr. Bulfer has acquired during the last few years doesn't yet do quite all the work he would like. Some feed has to be hauled to that big feeder for the sows, and some for the chickens and the few head of cattle he keeps. Next addition will be an auger type loader and unloader for a wagon so that even these minor scoop shovel jobs of feed hauling will be done mechanically.

If we are making Bulfer appear a lazy man, we do it quite unintentionally. Many years ago he suffered a back injury which continues to bother him. Once his doctors suggested that he give up farming, but farming being the only thing he cared to do and liked to do he refused to follow

that advice. Instead he set out to do all that could be done mechanically, and always as he has done his chores he has dreamed of the kind of equipment he wanted. The granary-corncrib-hog house combination, most of which was built last fall is a culmination of most of those dreams.

Cleaning still is a hand chore requiring two hours every other day. That the Bulfer hog house is kept clean, and that the hogs are kept under conditions as sanitary as possible is to be seen in the hogs themselves. Only two of the 225 head marketed in early February this year could be called runty, and one of them had been injured.

For his summer management, Bulfer has three long and narrow seven-acre pastures. One is in alfalfa and in that one he farrows his pigs in individual farrowing houses. The next year that pasture will be in corn, and the following year grain seeded with alfalfa. Thus a never varying three-year rotation is followed. At the building end of the pastures is a concrete walk over which the pigs travel to the buildings for feed and water after they are large enough.

To be doubly sure that contamination is not carried over on this walk and in the buildings from year to year, walk and buildings are given a thorough cleaning just before farrowing. All surfaces, and that includes the walk too, are washed with a strong lye water solution to get the dirt off, and the washing is followed with a burner that throws a 2,200-degree flame.

The pig crop marketed recently is proof that good feeding and careful attention to sanitation as well as good breeding pays off. There were 28 sows that farrowed in June. From these he got the 225 pigs that appeared to be averaging about 300 pounds when we saw them. That would be approximately 2,400 pounds of pork per litter in a little less than eight months.

New Sulfa for Coccidiosis Control

Condensed from Poultry Tribune

Karl C. Seeger
University of Delaware

ONE of the newer and more powerful sulfa compounds now being used for controling coccidiosis is sulfamethazine.

Several scientific workers in England and the United States have been experimenting with sulfamethazine since 1942. They wanted to find out how effective it might be and how much is required to give the greatest protection from losses from coccidiosis when birds were inoculated with the disease.

This drug has been under study at the University of Delaware Substation since 1945 to find the best practical way of using it in treating natural outbreaks of coccidiosis. During this time sulfamethazine has been used in groups of chicks ranging in size from 20 to 10,000.

The experimental work with sulfamethazine was divided into three phases: 1. Close study of chicks in batteries inoculated with definite numbers of coccidia and treated with definite levels of the drug: 2. Groups of 150 chicks on the floor inoculated and treated and later tested for immunity; 3. Intermittently treating natural outbreaks of coccidiosis in large commercial sized pens of chicks and in field flocks. Along with these studies, comparisons were made with identical groups using sulfaguanidine and with groups in which no treatment was used. The details of what happened in these experiments follow.

At various times chicks in batteries were inoculated with 100,000 sporulated bloody or caecal type of coccidial organisms. Beginning at 48 hours after the inoculation, groups of chicks received sulfamethazine at the rate of 0.4 percent, and sulfaguanidine at the rate of 1 percent in the mash for three successive days. Other similar groups received no treatment. On the eighth day after inoculation all surviving chicks were killed to observe the severity of the lesions in the caeca.

Of the chicks receiving sulfamethazine, none were lost and 30 percent showed very slight lesions in the caeca. Others receiving a 12.5 percent liquid solution of sodium sulfamethazine at the rate of two tablespoons (32 cc.) per gallon of drinking water were protected equally as well as were those

Reprinted by permission from Poultry Tribune, March, 1948, Mount Morris, Illinois

receiving powder in the mash. Two groups receiving a smaller amount of the drug had no losses, but showed pronounced lesions in the caeca.

Sulfaguanidine at the rate of 1 percent in the mash gave a loss of 5 percent in two similar groups. Lesions of varying severity were present in practically all survivors. Those receiving no treatment had an average loss of 40 percent, with all survivors showing severe lesions.

These results in batteries have value in demonstrating definitely that sulfamethazine is highly effective in checking the course of the disease after chicks are inoculated with it.

The next step was to determine whether these birds were immune to the disease. For this purpose three groups of 150 chicks each were used. The coccidia were mixed in a wet mash and fed to the chicks. Sulfamethazine was given in the same manner as was done in the battery groups; namely, beginning 48 hours after inoculation 0.4 percent powdered sulfamethazine was given in the mash and continued for three successive days. No losses or evidence of sickness occurred in the treated groups, while 75 percent died in the two untreated pens. The pens receiving 1 percent sulfaguanidine had a loss of 10 percent.

Two weeks later all surviving chicks received a second dose of coccidia without treatment. No losses or evidence of coccidiosis appeared. Twenty-five percent of a susceptible group inoculated for the first time died, however, demonstrating the potency of the inoculating organisms. This phase of the experiment proved clearly that sulfamethazine under these controlled conditions was 100 percent effective in controlling losses from caecal coccidiosis. At the same time the chicks became immune or highly resistant to further attacks of the same disease.

The next step was to apply these known facts to the best advantage in flocks coming down with natural attacks of caecal coccidiosis. A flock of chicks coming down with natural infection differs from an inoculated group in that the chicks are in all stages of the disease, including some still uninfected, at any one time.

The ideal time to feed the drug to an individual chick was found to be 48 hours after inoculation. The basic problem in a natural outbreak is to feed sulfamethazine at a time when the greatest number of chicks are in the right stage of infection. This was found to be handled best by feeding sulfamethazine at the earliest noticeable sign of the disease in an individual pen. Three one-day treatments of 0.4 percent separated between treatments by three or four days on regular mash seemed best.

This intermittent system is not

perfect, but the results in practice indicate that the greatest number of birds will be benefited. The periods of regular mash feeding allow susceptible birds to become infected before the next treatment.

An indication of what sulfamethazine will do when properly used in a natural outbreak of caecal coccidiosis is shown in the results obtained in a flock of 10,000 broilers. One group of 2,500 was given the owner's usual treatment of bran, cornmeal, oats, and buttermilk during the course of the disease. The remaining 7,500 were treated intermittently *by pens* with sulfamethazine. The pens treated with sulfamethazine had a final loss of 4.4 percent from caecal coccidiosis. The grain-buttermilk treated group had a loss of 15.7 percent. The losses from all other causes was 4.8 percent in each group.

The course of the disease and the losses per day in the grain-buttermilk treated group followed the characteristic pattern of an untreated group. The mortality rose rapidly, stayed at a peak for about four days, then gradually declined, covering a period of 33 days. In the sulfamethazine treated pens the mortality occurred in broken groups with no loss on days following each treatment. The overall period of losses also was shorter by several days.

Also of particular note in this flock was a considerable lapse of time between the first loss in the first pen to come down with the disease and the first loss in the last pen to come down. A general flock treatment given when symptoms were noted in the first pen would not have benefitted the pens that came down last. Thus the importance of correlating the treatment with the disease by pens is shown.

Numerous other sulfonamides and other drugs have been tested here at the Delaware Substation in the search for an effective, cheap treatment for coccidiosis. In comparative tests two other drugs look promising. The first is chlorosulfadiazine at 0.2 percent, which is equivalent to sulfamethazine at 0.4 percent, but, unfortunately, is slightly toxic at the effective level.

The second drug that appears to have all the desirable characteristics of a coccidiosis treatment is sulfaquinoxaline. This drug at 0.2 percent is equivalent in effectiveness to 0.4 percent sulfamethazine. Exhaustive tests have not been completed, and the drug has not appeared on the market in this area. At the present time sulfamethazine is available for use and represents the most effective drug treatment for both caecal and intestinal types of coccidiosis. Other known effective drugs may become available soon and prove to be equal to or superior to sulfamethazine.

Drugs usually serve a single purpose. Sulfamethazine has the rare distinction of serving two purposes. Besides being effective against the various species of coccidia, it is also effective against an entirely different disease; namely, fowl cholera, which is a bacterial disease.

In certain cholera infected flocks, reports have shown a reduction of as much as 45 to 75 percent in mortality in sulfamethazine treated groups when compared to untreated groups of the same infected flocks. Several flocks under our observation here were treated and the mortality from this cause vanished after four days.

In one particular flock, cholera broke out in one pen of a 20,000-bird flock at eight weeks of age. Sulfamethazine was given to this one pen only, with a rapid stopping of losses and no spread to the remainder of birds.

The indications are that this drug can serve a very useful purpose to the broiler grower by checking this deadly disease and making it possible to hold broilers until they reach a marketable size.

In field trials involving natural outbreaks of cholera, sulfamethazine was used successfully at the rate of one-half pound in 100 pounds of feed on an intermittent schedule of three two-day feeding periods separated by four full days on regular mash.

Pullorum and fowl typhoid are two other diseases for which sulfamethazine has shown promise as a control.

With new drugs being discovered and becoming available on the market, some growers have stated that they are confused. It is well to keep in mind that these drugs all do a definite job. They have definite limitations and must be properly used. The job they will do; how to use them; and for what disease is stated on the label. Follow it carefully, for these drugs are costly. A lot of money can be wasted through their misuse or use on the wrong disease.

Another reason for reading the label carefully is that sulfa compounds are not always sold by their common name. The brand name of a particular manufacturer may be added or even used alone. This does not affect the effectiveness of the drug, but does make it essential for the user to be sure that he is using the right drug and that he is following the manufacturer's directions.

Experiences with Ladino Clover

Condensed from The Ayrshire Digest

S. N. Stimson

I DO NOT own a plow and I have no intention of buying one. I own no cultivator, cultipacker or corn planter. We began putting up grass silage in 1936, and for five years our cows never ate a spear of hay. They were the best lot of cattle we ever raised—heavy producers with big middles and nice udders and nearly free from udder and breeding trouble. During the war period we wintered 70 head on grass silage, and in addition to milk at the peak of production we produced in a year 15 purebred cows for sale, 16 tons of poultry meat, kept 4000 laying hens and packed 1410 cases of eggs.

Let's go back to 1921 and see how this came about. In that year I started on these thin acres and the first year we harvested eight loads of daisies, paint brush and quack. We started a four-year rotation of corn, oats, and alfalfa for two years and were among the first in the valley to have alfalfa. This worked out well during the 1920's and we wound up by wintering 70 head of cattle and selling about 50 tons of hay a year.

Then came the depression. Fixed charges were the same, and with reduced income we had to do something and do it quickly. We began to add poultry and convert barn space into quarters for poultry. That used up our hay storage, and, as I never liked to sell hay, I built my first 50 × 14-foot silo. It wasn't enough, and the next year we built the mate to it.

To save labor, we put all our acres into Ladino and timothy. Alfalfa couldn't stand the competition and disappeared. Then we went after the pasture. We removed thorn apples, boulders and stumps, and leveled cradle knolls. We put on two tons of lime, 400 lbs. of superphosphate, 10 loads of manure and 1 lb. of Ladino clover seed to the acre. We wound up with three acres of buildings, 42 acres of planted trees, 54 acres of improved pasture and 60 acres of permanent hay. We clipped all the pasture every year.

With 3500 laying hens and about 70 head of cattle, we now manure every acre of permanent hay and pasture at least once a year, and to each load of manure we add 100 lbs. of superphosphate. Our stands do not run out, the

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oldest having been in eight years. Feed Ladino and it will stay.

Grass silage is the most economical crop to produce and harvest in the Northeast.

Timothy, if cut when or before it heads, will produce excellent results, but we find timothy and Ladino our best bet. One pound of Ladino per acre and enough timothy to get an even distribution is sufficient on our farm. Our soil has long since had enough lime.

Four hundred pounds of 20% superphosphate will help the stand get established. Go easy the *first year* on manure, or Ladino will not stand the competition. After that, ten tons of chicken manure or fifteen tons of cow manure will keep the crop improving and will give one to seven cuttings a year, depending on weather conditions. We cut our poultry range seven times one year and the loader handled each cutting, but with difficulty because of the softness of the product. Ladino is a heavy feeder and its survival depends on early and frequent cutting so the competing plants cannot get the upper hand.

After ten years of climbing off and on a mower, we have learned a few things. We try to do our cutting *when the wind is blowing.* Whenever the *air is moving,* we stop everything and cut all we can handle before it gets too dry. Ladino cuts just as hard on a hot, muggy afternoon as it does in the rain. Young four-weeks-old Ladino cuts easily, but after that, more and more of it matures and joins previous accumulations on the ground. By using rock guards and a power mower, cutting very close each time and following the procedure outlined above, we have taken the headache out of the harvest.

One of the cuttings after the first one each year should stand long enough so that a few seed heads will be shed for reseeding just in case the old stand takes too much of a beating the next winter.

We established much of our Ladino on pastures without plowing or dragging and have never used over one pound of Ladino to the acre. March is the best month in the year to sow the seed.

Grass silage will produce *more* milk with *less* grain than any crop we ever grew. Seasonal breeding troubles are reduced to a minimum, a big point in maintaining a fall dairy. Additional dry hay seems to make the cattle happy but adds nothing to their production, condition, or general health.

After our silos are finally settled and full we make some dry hay. We don't consider it a necessity, but it saves all the crop and we feed it as a night-time snack. Grass is the ideal cattle food, and for winter feed, silage made from this same tender grass is the nearest approach to the ideal.

Weather and Management Influence Calf Health

Condensed from Farm and Home Research

W. D. Pounden, J. W. Hibbs, and W. E. Krauss[1]
Ohio Agricultural Experiment Station

THE incidence of sickness, more especially diarrhea, in young calves reaches major proportions in some herds. Numerous factors have been blamed for this. Various remedies have been suggested and many have been credited with having accomplished the desired results. However, the problems still exist. One reason for this is that the causes are numerous. The cause of such troubles must be removed or not be permitted to exist. This is often difficult to accomplish because of the inadequate means for determining the cause.

This story developed during attempts to discover the causes of attacks of diarrhea which were prevalent in the calves of three herds. Herd A was composed of both Jerseys and Holsteins; the other two were Holstein herds. These herds were all being operated under what would generally be considered good conditions with adequate equipment.

The table gives the status of the herds in regards to number and breed of calves born during the period of observation, the number of calves which had diarrhea during their first 20 days of life, and the average number of days the calves were affected during the 20-day period. It is apparent that in herd A the incidence of diarrhea in Jerseys was much higher than in Holsteins and that the incidence of diarrhea in herd B (Holsteins) was higher than in herd C (Holsteins) and much higher than in the Holstein group of herd A.

A review of the ages of the calves when they were affected

[1] The authors wish to acknowledge the assistance received from the Ohio Department of Public Welfare, especially J. D. Bragg and the farm managers and dairymen at the various institutions.

THE INCIDENCE OF DIARRHEA IN 140 CALVES FROM THREE HERDS BETWEEN DECEMBER 1, 1945 AND MAY 10, 1946

Herd	No. cases diarrhea	Percent cases diarrhea	Av. No. days per case
A—28 Jerseys	20	71.4	3.4
A—11 Holsteins	2	18.2	1.5
B—50 Holsteins	32	64.0	5.0
C—51 Holsteins	20	39.5	2.3

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showed that these varied to quite an extent depending on which herd they were in. With very few exceptions, the attacks in herd A began when the calves were between 6 and 12 days of age; in herd B between 7 and 15 days; and in herd C between 10 and 15 days. Herd A was the only herd observed during the following year and attacks were again noted to be prevalent in the calves when they were of the same age as those in the previous year.

The presence of diarrhea in the calves in these three herds was examined in relation to the minimum daily outside temperature trends that existed at the Experiment Station to see if any influence of the weather could be detected on the incidence of attacks. The weather data were obtained from the records kept by J. T. McClure, climatologist for the Experiment Station.

Herd A was located in the north central part of the state and the other two herds in the southern half of the state. A spot check of weather records indicated that temperatures and temperature trends were reasonably comparable between the different districts. However, trend variations between areas would occasionally be as much as 24 hours and the daily lowest recorded temperatures generally were less extreme in the southern parts of the state.

It was found that cases of diarrhea were present in herd A during several periods of a few days each. In each instance the attacks had started at times when minimum daily outside temperatures were dropping, or had dropped quite markedly, at least to freezing temperatures. The duration of these periods of sickness coincided to some extent with the duration of the cold waves. That this was not the only factor which stimulated attacks was indicated by the fact that there were other low temperature periods when no diarrhea cases were observed.

A summary of these observations on the three herds is given below. The first column of figures gives the number of instances when attacks occurred during or following quite sudden downward trends of minimum daily outside temperatures. The second column shows the number of times attacks did not materialize under similar weather conditions. The third column refers to the number of times

Herd	Diarrhea cases present—weather quite suddenly colder	No diarrhea cases—weather quite suddenly colder	Diarrhea cases present—weather warmer
A	8	4	1
B	10	4	0
C	5	7	2
Total	23	15	3

attacks occurred during trends towards warmer weather.

The figures indicate that attacks of diarrhea in the young calves were associated to quite an extent (especially in herds A and B) with suddenly lowered temperatures when the calves might readily become exposed to chilling temperatures to which they were not accustomed.

During the following year the influence of the weather on the incidence of diarrhea was not as well defined in herd A, the only herd examined, as during the previous year. Some effort was made to limit the effects of temperature changes. There were 8 severe attacks of diarrhea and all occurred during one or another of the five coldest periods of the winter.

There is a tendency in many herds to attempt to save time and otherwise deviate from the usual routine when doing the chores during week ends and holiday periods. That this might play a part in the incidence of attacks of diarrhea seemed possible. If it did so it would be logical to expect an abnormal number of attacks to begin on Mondays and Tuesdays, or following holidays. The results of a comparison of the days of the week when diarrhea was first observed in the three herds are given in the following tabulation.

It would seem to be highly improbable that Mondays and Tuesdays should be so predominantly the days of onset of attacks of diarrhea unless management factors during the week end were involved. A check of the birth days of the calves showed that they were evenly distributed throughout all 7 days, which eliminates the possibility that the day of the week the calves were born influenced the time of occurrence of diarrhea.

It appears from these observations that sudden downward trends in temperature, leading to chilling of calves, and poor management procedures during week ends were among the inciting causes of diarrhea in these three herds. The variations that existed between herds in regard to the ages when attacks started, the presence of many attacks on days other than Mondays and Tuesdays, and the failure of attacks persistently to follow weather changes indicate that

THE INFLUENCE OF CHANGES IN ROUTINE

	Monday and Tuesday	Other 5 days combined	Total calves
Herd A No. attacks started	12	11	23
Herd B No. attacks started	17	15*	32
Herd C No. attacks started	10	10	20
Total No. attacks started	38	36	74

* Includes three cases that started on the two days following Christmas day which might well be included in the Monday-Tuesday group.

other factors were present which rendered the calves susceptible to attacks of diarrhea. The search for these factors continues. There are indications that faulty development of rumen digestion may be involved in this problem.

The moral: Keep regular hours for feeding young calves and prevent them from becoming chilled when weather temperatures are making a sudden drop to freezing levels.

Furniture for Laying Pens

Condensed from Everybodys Poultry Magazine

G. T. Klein

IT TAKES a lot of equipment for a pen of layers. That's especially true if the pen has a bird for each three square feet of space. Feeders and fountains seem to cover the entire floor area, leaving little more than enough space to walk about.

Let's take a look at the kind of feeders, carriers, roosts, waterers, nests and broody coops that some prominent poultrymen are finding successful. They'll vary considerably, but that just goes to prove that there are a good many ways of doing the same job.

It's a funny thing about feeders. Put low and high feeders in the same pen and the flock will eat from the low ones. But put all reasonably high feeders in and they eat as much and lay as well as though their feed was on the floor. Height, you've got to conclude, isn't terribly important. I can see no saving in floor space by using a high feeder.

There's a lot said about no-waste hoppers. There is an obvious difference in the amount of feed birds can hook out of feeders of different construction. Poultrymen tell me the height of filling has more influence than the construction.

If you ask Homer Rowell, an Essex County, Mass., poultryman, what kind of a feeder he likes, it would be the customary V-shaped trough with lip and a piece of door spring and heavy wire over the top of it. The spring, he contends, keeps birds off as well as a reel would and makes it easier

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to fill hoppers without spilling feed.

Carriers are just about as important in houses three pens in length ar longer as doors and windows. You can build your own or buy a commercial carrier. There's no difference in the kind of job they will do.

Some carriers are built with a platform for feed, pails of eggs, crates of poultry, or bundles of litter. Sides can be put on the carrier for moving droppings or floor litter. This cleaning is something that I think can more easily be handled through doors, windows, chutes, or litter removers.

On a number of prominent farms, feed is emptied from bags into pails in the feed room. The pails are moved on the carrier into the several pens. Others do not use pails, putting bags of feed on the carrier platform. There are others who have metal bins large enough for a few bags of feed right on the carriers. These are filled in the feed room and feed is dipped out with scoops to fill hoppers.

There are still other ways of building carriers. These include fastening a piece of iron with hooks onto garage door track rollers. Sometimes hooks are fastened to a piece of heavy plank and this, in turn, is fastened to the garage door rollers. Pails of feed are hung from the hooks.

Probably 90 percent of the poultrymen of Massachusetts have droppings pits in their pens. In most houses these are along the rear wall. Usually they are about 24 inches high and 5 to 6 feet wide, with 13 inches of space between roosts. Inch-and-a-half-mesh wire is tightly stretched under the roosts. The pits are cleaned by raising the roosts, removing boards in the front of the pits, or by lifting the entire section out of place. While cleaning is not done more than three or four times a year, it shortens the job to have clean-out doors in the back of the pen.

I'm one who can see no disadvantage in pits. To me there is every advantage in them over the dropping boards. They have been used for 15 to 20 years in some houses without rotting the floor boards. They are no more of a disease hazard or fly menace than droppings boards.

The waterer is the biggest question mark of all. There are plenty of them that keep birds automatically supplied with drinking water but there is a certain amount of water throwing from the average waterer in use.

I have observed that there is less water throwing when the drinking pan is on the level or perhaps lower than the platform the birds stand on. Perhaps if they have to dip their heads to get a drink, they get less on their wattles. I've concluded that no matter

how much you try to catch the spill, you are sure to have considerable water throwing. In large pens there is such a concentration of drinking in a small area that there is bound to be wet litter around the fountains. Some litter changing around the waterers is usually necessary in winter. If you leave it, there is considerable creeping, wetting a larger area.

Insulated buildings well filled with birds are usually warm enough so that freezing of water pipes is not a problem. When protection is necessary, heating cable is the answer to the poultryman's prayer. Installed with a thermostat, the cable warms the exposed pipe when the temperature drops below freezing. Electric water warmers keep water in pans from freezing.

Poultrymen in Massachusetts are divided in their opinion on two types of nests. Some like the conventional front entrance nest about 14 inches square and 16 inches deep. An equally large number like the tunnel nest, with a preference for a recent modification called the Massachusetts Clean Egg Nest. The latter gives the least trouble from litter working out of the nest of anything so far used. There is an occasional flock that does not like to go in this nest to lay. It is probably because they learned to lay in some other type of nest.

We have little need for broody coops in our flocks of production bred birds. Here broodiness has been cut to 2 or 3 percent. The stock that produces the broiler hatching eggs is quite a different story. It seems to work out well to have two coops in each pen. In the late afternoon, broodies are confined to one of the coops. Those in the other are liberated. It's too much to expect that no birds will go back to the nest after two days in the coop. They'll be picked up on the next round and again confined.

Almost any type of coop that has a wire or slat bottom is okay. You'll need a place for feed and water. The coops can hang from the wall or be over the pit.

The right kind of equipment makes the job easier, results more positive.

Soil Qualities and Management

Condensed from The California Cultivator

R. S. Stephenson
Oregon State College

Soil is a mechanical mixture of sand, silt and clay with a portion of organic matter partly humified and partly in the raw state. Sand is primarily silica and not a plant nutrient nor a source of plant nutrients, yet it may make up one-fourth to half or more of the bulk of the soil. Some soils, however, contain mineral particles such as bits of feldspar, mica, and other things that are of sand size and would be classed as sand in a mechanical analysis. These coarse particles are ultimate nutrient sources.

Silt, on the other hand, is mostly incompletely decomposed minerals that represent a reserve nutrient supply. This material is finer than sand but coarser than clay. The immediate availability to the plant of nutrients held by the silt is usually not as high as that of nutrients held by clay or humus. Silt is constantly, slowly decomposing, however, and some nutrients are liberated to the plant while others are reabsorbed by the clay or humus.

Clay is the fine fraction of the soil and is a new product entirely different from the original soil minerals. It is one of the products of the reaction of water and the original soil minerals. The clay particles may adhere to the surfaces of sand grains, or they may clump together in varying sized aggregates.

The relative proportion of sand, silt and clay establishes the soil textures, such as loams, sandy loams, silt loams, clays and others. Soil texture is an important physical property because it determines or modifies so many other properties, such as porosity, size of pores, moisture retention, drainage, aeration, ease of culture and methods of management. The more desirable general purpose textures are the loams, sandy loams and silt loams. Less desirable are the coarse sands, silty clay loams and the clays.

A second important physical property is the structure of the soil which is sometimes defined as the way the particles of sand, silt and clay are arranged, whether dispersed or whether in large or small aggregates. The most important feature of soil structure is

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the size of the pore spaces. A mass of granular soil that acts like a sponge (a sponge is mostly holes) has the ideal structure. Small pores called capillaries retain the moisture for crop use. The large pores provide drainage, aeration and a place for roots to penetrate and develop. A good peat soil has nearly an ideal structure. When facilities for water removal, such as ditches and tiles are provided, the peat soil drains easily and yet has good moisture-retention properties and is well aerated. Good peats, when properly managed and fertilized, produce heavily because of the good structure favorable to the development and normal functioning of the root system.

A third important physical property of the soil is the depth to which roots can develop and function. Roots do not penetrate much into tight water-logged subsoils, nor would they function to support good plant growth if they did penetrate where there is little or no aeration. Roots of any plant will go deeper in soils that have good structure, and that are drained and aerated. Some plants need ten or 12 feet of good soil for normal development and production. Some wet land grasses may thrive with relatively poor drainage, little aeration and shallow depth. But the greatest number of farm crops require good deep soil for highest production. Soil that is good to a depth of ten feet or more, can be used to grow nearly any crop that is acclimated. On the other hand, soil that is good for only two feet of depth is suited to very few crops, and these probably will not produce maximum yields for lack of adequate root volume to support the top growth necessary for a big harvest.

Soil is a Chemical System. Soil is a storehouse of nutrients and the seat of chemical reactions that make the nutrients available to the plant. Assuming that the physical properties, moisture, temperature and other factors, are favorable, crop yields will be somewhat in proportion to the supply of nutrients that are readily available. Sustained high yields depend upon the reserve of nutrients and the rate at which these become available over a period of years.

The exact number of elements necessary for plant growth is not known for a certainty. The old idea of ten essential elements has been abandoned and four more have been definitely added to the list. These are copper, zinc, manganese, and boron. Evidence is accumulating that a fifth element may be added to the list of those required. In certain localities in Australia it is reported that crops fail until molybdenum is provided. Only two ounces of molybdenum oxide per acre does the trick but apparently that two ounces is just as much a limiting factor in plant growth as if sev-

eral pounds were required. No doubt other elements may sometimes be found essential.

The reaction of the soil, whether it is acid, near-neutral or alkaline, is an important crop yield factor. Bad alkali is a more serious problem than high acidity, harder to control and more injurious to the crop. In fact, bad-alkali land is nearly worthless for agriculture. Acidity, on the other hand, is controlled relatively easily by use of liming materials. The capacity of the soil to supply available nutrients to the crop is more important than acidity. Acid soils are often low in available nutrients.

Good soil is a living system teaming with plant and animal life, one of the distinguishing features that differentiates productive soil from an inert mass of finely powdered minerals. As rock disintegrates to form soil, the living population gradually multiplies and soon surface vegetation appears, humus accumulates and the growth of plants increases accordingly.

The animal life of the soil consists of earthworms, ants, mites and many others in countless numbers. It has been stated that 95 percent of all insects spend some part of their life cycle in the soil.

The larger animal organisms, such as the earthworms and the arthropods, are soil structure-developing organisms. Good soils are riddled with cavities and channels, the work of animal life that tunnels through the soil or eats out the roots of dead plants leaving open channels for water penetration, drainage, aeration and the development of the roots of planted crops. The holes in the soil, those just large enough to be visible to the eye or larger, are just as important to crop production as the finer capillaries or the solid grains of sand, silt and clay, or particles of humus.

A good soil with a vigorous plant cover has many living plant roots. It has been estimated that 10 percent of the total organic matter in the soil may be living roots. When the plant dies the roots rot and leave open channels. Plants with large root systems are especially valuable for improving the soil. Clovers have been called natural soil aerators because of the many large roots that penetrate deeply to open the soil.

Good Management. The object in soil management is to integrate the physical, chemical and biological properties of the soil in such a way as to get good crop production and at the same time maintain or improve the general fertility level. Most soils can be improved but some may be so unsuited for cropping because of adverse physical properties that improvement is not economically

feasible. Often the good soils can be most improved and there is profit in the improvement.

Soil texture can not be changed and effective soil depth usually can not be increased very much. Structure is the important physical property which can be improved. The best structure is usually maintained where there is the minimum of cultivation. Crop rotation, with sod crops occupying the soil much of the time, is favorable to good structure development. The soils of the old, much-cultivated fields on the other hand, run together, lose their structure, become soggy when wet, or nearly as hard as cement when dry. This is especially noticeable on the heavier textured soils.

Humus materials, manure, compost, straw and the residues of plants, should return to the soil. These materials are food for structure-developing animal life. They are also food for bacteria, which aid the humification process and help to bring about granulation and develop a spongy condition.

Chemical phases of the soil fertility problem are more easily controlled than the physical. A deficiency of any plant nutrient can be easily corrected by using the proper material on the soil or sometimes as a spray on the plant. However, it is often difficult to discover just what the nutrient deficiency is.

Biological problems of the soil are usually concerned more with the destruction of harmful organisms of which there are a few, such as wire worms and symphylids. Large numbers of desirable organisms are introduced into the soil, however, in stable manure and compost. Legume organisms are introduced by seed innoculation when growing such crops as clover, vetch and alfalfa.

All crops require air, water and nutrients from the soil. The relative needs of different crops vary considerably, however. Berries thrive with a moderate amount of acidity, but alfalfa needs a nearly neutral soil. Grass may thrive in shallow moist soil, but a walnut tree requires a deep, well-drained aerated root zone. Corn can hardly be over fertilized, because of its capacity to use a large amount of nutrient. Oats will not stand heavy fertilization or they may lodge and fail to fill.

Management practices must be adapted to both the soil and the crop. Tillage of heavy clays when wet may ruin their structure, whereas cultivation of wet, sandy soil may do little harm. A heavy roller on moist clay may reduce yields. Fluffy peats are sometimes rolled with weighted rollers while moist to compact the bed and increase yields. Potatoes like a deep mellow seedbed with a well aerated root zone. Many grasses succeed well or better with a shallow

firm seedbed and more limited aeration.

In management practice, therefore, the efficient grower thrives to know both the capacity of his soil and the specific needs of the various crops. It is usually more practical to choose a crop that is suited to the soil than to attempt any large scale modification of the soil to meet the needs of the crop.

Given a soil with loam or sandy loam texture, a mellow sponge structure, and a depth of ten feet or more where roots may penetrate and function normally, management problems do not usually loom large. The best accepted practices applied to such soil will probably enable the grower to produce any crop he chooses with reasonable success, and perhaps to improve the soil for future use. This is assuming that the climate, temperature, moisture supply and other factors are favorable.

Are You Over-liming?

Too much lime can be as bad as too little. So if you aren't sure your soil *needs* lime, it's safest to have a test made before you lime it.

At the Tennessee Experiment Station corn yielded only 2½ bushels per acre following a 10-ton-per-acre application of limestone. Land getting only 2 tons of lime yielded 29 bushels. Soil on both of the plots was low in potash.

Heavy liming of sorghum and soybean land also slowed the growth of these crops, and cut yields.

Oats on land which 8 years earlier had received 8 tons of limestone yielded 13.7 bushels to the acre, as compared to 26.8 bushels on land that got only 2.5 tons of lime.

Different soils have different lime needs. When put on right, and in the right amount, lime will often increase corn and small-grain yields by 4 or 5 bushels, and legume yields by a ton or more per acre. In the Tennessee tests alfalfa, clover (sweet, red, and alsike), and Korean lespedeza all yielded more with moderate liming. But too much lime hurt them.

—Farm Journal

Does Your Farming Need an Overhaul?

Condensed from Successful Farming

Francis Kutish
Iowa State College

Ask yourself these five questions:

Am I producing as much as I can per worker on my farm?

Am I doing a large amount of business relative to investment?

Am I planning a program that gives a high income per acre?

Am I receiving a high return on the feed fed on my farm?

Am I keeping machinery cost per acre at a low figure?

Maybe you think you're a pretty good farmer. Times have been good, and you have made money. But don't confuse inflation income with efficient management. You have a squeeze coming in your farm business, and 1948 is none too soon to get ready for it.

It's high time to do a little planning, not only for 1948, but for the years ahead. The good farmer five years from now will be the fellow who overhauls his farm business now just as he would overhaul his tractor before the spring work. Make sure, don't guess, that your farming operation is hitting on all cylinders.

We have just finished seven fat years. Prices for farm products, and profits, too, have risen constantly. Costs of farm operation have been climbing higher—but not as fast; now the price of almost everything you buy and your cost of operating your farm are climbing faster than the prices you receive.

The real day of reckoning will come when prices of farm products fall from the present high level. There is no way to determine that accurately. One thing is sure: When an inflationary boom is prolonged—like this one—farmers are left with permanently higher costs. Machinery, equipment, labor—all cost more than before. Costs rise slower than prices received for farm products, and they tend to stay high even after all other prices have fallen.

That's the painful, two-way squeeze American agriculture was caught in for nearly 20 years after the other war—lower prices and sticky costs. Your chief concern should be ways of cutting costs and increasing your farm efficiency.

What can you do about it? The first thing is to recognize what is happening. Farm records kept by

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more than 700 farmers in cooperation with Iowa State College show that operating expenses on their farms in 1946 were nearly 2⅓ times what they were in 1939, and 1947 costs were still higher. Despite high profits, expenses for farmers are climbing faster than production.

It's not easy for anyone to pull down costs, but actual experiences of record-keeping farmers show there are some things we can do to hold up profits. Here they are: (1) Aim for high production per worker. (2) Do a large amount of business in relation to your total investment. (3) Plan for a high crop income per acre. (4) Have a high return per dollar of feed fed. (5) Watch your power-and-machinery costs per acre.

An efficient farm operator must watch all parts of his business. A man has to be good on all scores. Doing a good job in just one part of your farm business does not necessarily mean money in the bank.

A successful farm produces the *highest net income* over a period of years, not just the most corn per acre or the largest litters of pigs, alone. The importance of this is shown by the fact that those members of the Iowa Farm Business Record Associations who were above average in four of the above-mentioned scores made just twice the profits of those who were above average in only two.

One of the first places to check is the amount of business done per man. Are you running as large a farm business as you could?

One way to do this is to make sure you have year-around livestock production. That's your best way to keep both yourself and the hired man busy.

Some farmers have spare time in the winter. That's the position Raymond Fisher, of Greene County, Iowa, found himself in a few years ago. Now he's feeding cattle during the winter. Cattle-feeding offers a good chance to market roughage and labor during the winter months when he is not busy with his field work.

To do the job right, cattle-feeding should be timed to fit the least-crowded season. Feeding silage and hay to cattle can take a lot of time, but here is the way Art Talstrup, Hamilton County, Iowa, gets around that. He chops his hay out in the field where he feeds his cattle. For shelter, he leans fodder against a fence. Talstrup's cattle spread their own manure, and haul their own hay!

Walter Brandt, of Benton County, puts his straw in the barn, and chops hay in stacks outside. He says, "I used to spend summers hauling hay into the barn and stacking straw outside. Then I'd turn around and spend my winters hauling straw into the barn and hay out to the feedlot. Now I store both nearer to where they're used."

Sometimes you can do a lot by shifting hog litters so the care of hogs doesn't pile up on top of April field work. This is another way to hold up volume per man.

In fact, hog production offers most farmers a bigger chance for short cuts than any other livestock production. Where equipment for cold-weather farrowing is available, pigs can be farrowed in February and early March. Chances are you will have more time to spend with hogs then, and you can do a better job. This way makes it possible for you to handle more litters than you could later in the spring when you are busy plowing and planting.

On farms where equipment is limited, farrowing usually should be pushed back until May or early June. This is especially important if you raise only spring litters. Many farmers have found this very profitable. They count on their lower costs at farrowing time to more than make up for inability to sell at the normal season of high prices in the fall.

Late farrowing has several strong points. It comes after corn-planting. It cuts out the need for many sanitary measures such as scrubbing the hog house; pigs can be farrowed right out on clean pasture. Sows almost take care of themselves at this time of year.

Fall pigs is another way to make good use of winter labor. To get the greatest benefit of sunshine and green feed, have your fall pigs come in late August or early September.

Many farmers may be able to change their dairy-farming programs to get more output per man. Lew Morris, Jr., of Dallas County, found that he could save several days' labor over a year's time by rearranging his barn. He discontinued the use of some of the old, conventional stanchions and remade his barn into pens. This saves several days of work in dairy chores over a year's time. What's more, he believes that he has had less udder trouble in his herd since he made the switch.

Your chances for cutting labor costs in producing crops are not as good as with livestock. But here is an idea that Raymond Fisher uses for a short cut in haying. Fisher stacks his hay in the field in the summer. Then he hauls it to the barn in the winter when the work is less pressing. In this manner Raymond and his hired man can put up 20 acres of hay in a day.

Another way to hold up profits is to get a higher return per dollar of feed fed. In the face of rising costs, Lew Morris has taken a step which has increased the returns per dollar of feed fed to his dairy cattle. At one time he was a heavy feeder of grain to his cows. Then he found that he could cut back on the amount of grain going to his dairy cows and

make up for it by feeding more high-quality hay.

"Roughage is generally cheaper than grain," he says. His total milk output is down a bit, but his farm accounts show that he is getting a higher return per dollar of feed fed. This means a higher net profit from the dairy herd; and net profit is what every farmer really is interested in.

Good pasture is one of the best ways of cutting labor and increasing returns per dollar of feed fed to dairy cows. As a rule, during the pasture season (April thru September), about four-fifths of the feed for dairy cows comes from pasture. The proportion of feed for beef cattle and sheep is larger. This means pasture conditions have a great deal to do with feed costs.

A little planning in this direction may make it entirely possible to produce a steady flow of milk and continuous gains on beef cattle during these months with the minimum use of expensive grain and silage.

More timely harvesting of hay in the summer can lower the feed costs for dairy and beef cattle the following fall and winter. This is possible because feed values in hay are increased greatly if the hay is cut at the proper state of maturity, then cured, handled, and stored to preserve the quality. This is especially important in the nation's dairy regions. But, unfortunately, many farms in this region cut hay too late for the production of top-quality hay.

One of the best ways to increase returns per dollar of feed fed to poultry is to shift to the all-pullet flock. But have the pullets come early for early pullets lay more eggs per year.

To hold up crop income is mainly a matter of choosing high-profit crops and getting good yields. Choose the crop that nets you the highest return over a period of years. This probably means seeding a high-quality legume instead of timothy and clover mixture.

New varieties also are coming in. Clinton Oats and Hawkeye Soybeans are but two. Plant the crop varieties that have the highest yields in your neighborhood.

Perhaps fertilizer will pay. But fertilizer costs money. Be sure you test your soil to find out what fertilizer you really need most. Otherwise you may get little return for the money spent. Your county agent can tell you where and how you can get the test made.

These are some of the ways farmers have found to overhaul their farm businesses. It is possible to lower labor costs per unit of product by higher crop yields, greater use of machinery, other laborsaving devices, better supervision, and farm-work simplification.

In the years ahead, more machinery will be used on farms.

This can be expected, despite the fact that labor will be more plentiful and farm-product prices and income will be lower. But, boosting the size of farm business and the output per man is one of the "musts" if we are to combat the squeeze on profits.

The danger point is reached when power-and-machinery costs go up but volume of output does not. That is why it is a good idea to keep a weather eye on power-and-machinery costs per acre. This cost figure will show you how efficiently you are using your equipment.

It will pay you to study your farm business. Ask yourself if you really have a well-balanced program. Are you using your labor fully thruout the year? Could you step up your output per man? Could you do a better job with your livestock?

In other words: Do you have a 30- to 50-percent margin above costs to weather the storm of lower farm prices? You may not need it this year. Sailing should still be pretty clear in 1948, depending on the foreign-aid program followed by this country. But let's not forget that rougher sailing can and surely lies ahead. Thinking farmers are figuring ways to make their operations as efficient as possible and hold cost to a minimum.

Milk Before Freshening?

The last few years some dairymen have suggested milking cows before freshening to cut down on milk fever.

The Wisconsin Experiment Station tested the idea on 46 cows last year. Based on breeding dates, milking was started ten days before the cows were to calve (actual range two to sixteen days). Nine of the cows, nearly 20%, had milk fever. This was about the same percentage as the rest of the herd.

V. R. Smith and T. H. Blosser, the men making the test, are still looking for an answer to the milk fever problem. They don't feel that milking before calving is it.

—Farm Journal

Recommended for The Farmer's Library

Animal Sanitation and Disease Control—By Dr. R. R. Dykstra, Dean, School of Veterinary Medicine, Kansas State College. The Interstate Printers and Publishers. $3.50.

A Living from Bees—By Frank C. Pellett, Field Editor of American Bee Journal. Orange Judd Publishing Co., Inc. $2.25.

Beef Cattle Production in the South—By D. W. Williams, Head, Department of Animal Husbandry, A & M College of Texas, College Station, Texas. The Interstate Printers & Publishers. $2.50.

Breeds of Livestock in America—By Henry W. Vaughan, formerly Prof. of Animal Husbandry, Iowa State College. College Book Co. $4.75.

Dairy Cattle Feeding and Management—3rd Edition—By H. O. Henderson, Prof. of Dairy Husbandry, W. Va. Univ., Carl W. Larson and Fred S. Putney. John Wiley & Sons, Inc. $4.50.

Dairy Science—By W. E. Petersen, Ph.D., Assoc. Prof. Dairy Husbandry, Univ. of Minn. J. B. Lippincott Co. $4.50.

Diseases and Parasites of Poultry—By Edgar Hugh Barger, D. V. M., Berkeley, Calif., and L. E. Card, Ph.D., Prof. of Poultry Husbandry, Univ. of Illinois. Lea & Febiger. 3rd Edition. $3.75.

Domestic Geese and Ducks—By Paul P. Ives, Pres. Am. Waterfowl Ass'n. Orange Judd Publishing Co., Inc. $3.50.

Elements of Soil Conservation—By Hugh Hammond Bennett, Chief, Soil Conservation Service, U. S. Dept. Agri. McGraw-Hill Book Co., Inc. $3.20.

Farm Records—By John A. Hopkins, Ph.D., Asso. Prof. Economics, Iowa State College. Iowa State College Press. $3.00.

Farm Management Manual—V. B. Hart, S. W. Warren, Ivan R. Bierly—N. Y. State College of Agri. Comstock Publishing Co. $1.00.

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $6.00.

Forestry in Farm Management—By R. H. Westveld and Ralph H. Peck. John Wiley & Sons, Inc. $3.50.

Grow Your Own Fruit—By M G. Kains, formerly U. S. Dept. of Agri.; Prof. of Horticulture, Penna. State College, Greenberg, Publisher. $3.50.

Hatchery Management—By Roland C. Hartman, Editor, Everybody's Poultry Magazine, and G. S. Vickers, Field Mgr., Ohio Poultry Improvement Asso. Orange Judd Publishing Co., Inc. $4.00.

How to Raise Rabbits for Food and Fur—By Frank G. Ashbrook, Fish and Wildlife Service, U. S. Dept. of the Interior. Orange Judd Publishing Co., Inc. $2.00.

Judging Dairy Cattle—By Edwin S. Harrison, Professor of Animal Husbandry, Cornell University. John Wiley and Sons, Inc. $3.00.

Land for the Family—A Guide to Country Living—By A. F. Gustafson, E. V. Hardenburg, E. Y. Smith, and Jeanette McCoy—N. Y. State College of Agriculture. Comstock Publishing Co. $4.00.

Livestock Judging Handbook—By Julius E. Nordby and W. Malcolm Beeson, Ph.D., Asst. Professors Animal Husbandry, Univ. Idaho. The Interstate Printers. $3.25.

Livestock Production—By Walter H. Peters, Chief, Div. of Animal and Poultry Husbandry, Univ. of Minn. McGraw-Hill Book Co., Inc. $4.00.

Making Pigeons Pay—By Wendell M. Levi, formerly Pigeon Section, U.S.D.A. Signal Corps. Orange Judd Publishing Co., Inc. $2.50.

Management and Feeding of Sheep—By E. T. Baker. Orange Judd Publishing Co. $3.50.

Modern Farmers' Cyclopedia of Agriculture—By Earley Vernon Wilcox, Ph.D., formerly U. S. Dept. of Agric. Orange Judd Pub. Co. $4.50.

Natural Principles of Land Use—By Edw. H. Graham, Chief of Biology Div., Soil Conservation Service. Oxford University Press. $3.50.

Pay Dirt—Farming and Gardening with Composts—By J. I. Rodale. Devin-Adair Co. $3.00.

Pleasant Valley—By Louis Bromfield, author, farmer, conservationist. Harper & Brothers. $3.00.

Practical Farming for the South—By Benjamin F. Bullock, now Prof. Rural Education, Atlanta Univ. Univ. of North Carolina Press. $2.50.

Profitable Poultry Keeping—By H. Clyde Knandel, Head, Dept. Poultry Husb. Penn. State College. Orange Judd Publishing Co., Inc. $3.00.

Repairing Farm Machinery—By Ivan G. Morrison, Asst. Professor Agri. Education, Purdue Univ. The Interstate Printers & Publishers. $2.25.

The Horse of the Americas—By Robert Moorman Denhardt, editor of Western Horseman; foreword by J. Frank Dobie. Univ. of Oklahoma Press. $5.00.

Weeds of Lawn and Garden—By John M. Fogg, Jr., Prof. of Botany, University of Pennsylvania. Univ. of Penn. Press. $2.50.

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"The man is a success who has lived well, laughed often and loved much; who has gained the respect of intelligent men and the love of children; who has filled his niche and accomplished his task; who leaves the world better than he found it, whether by an improved poppy, a perfect poem, or a rescued soul; who never lacked appreciation of earth's beauty or failed to express it; who looked for the best in others and gave the best he had. His memory is a benediction."

—Robert Louis Stevenson